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*GLACIAL PHENOMENA BETWEEN LAKE CHAMPLAIN, LAKE GEORGE AND HUDSON RIVER.**

THE area between the south ends of Lakes Champlain and George and the Hudson River presents many very interesting glacial phenomena. The watershed between the basins of the St. Lawrence and the Hudson pursues a very remarkable course. Halfway Brook, a tributary to Wood Creek, which enters Lake Champlain at Whitehall, rises within the limits of the city of Glens Falls, upon the Hudson, and not more than a quarter of a mile from the Hudson. The brook occupies a broad, deserted river channel about one-half mile wide, leading through deep deposits of sand and gravel. The elevation of the gravel margins above the sea at Glens Falls is 343 feet; that of this deserted river channel is from fifty to seventy-five feet lower. A dam of twenty-five or thirty feet just above Glens Falls would turn the Hudson River through this old channel by way of Halfway Brook and make it a tributary to the St. Lawrence.

* A paper read before Section E, at the meeting of the A. A. A. S., at Springfield, Mass., August, 1895.

An extensive area northwest of Half-way Brook is occupied by sand plains and kames. For about a mile the sand plain bordering the channel presents a pretty sharp front towards the channel and slopes gradually away towards the mountains. On riding over this from north to south, while the slope is so gradual that one does not perceive it directly, it is made evident by the skyline which is formed by the tops of the mountains far to the south, giving one the sensation of being in a vast sandy plain surrounded by abutting mountains on all sides. I am indebted to Mrs. C. B. Hewitt for having my attention directed to this peculiar feature.

Nearer the head of Lake George and south of French Mountain the gravel deposits pass into those of a very broken character, with innumerable kames and kettle holes, one of the largest of which is occupied by Glen Lake, while an extensive series of eskers fill the depression west of French Mountain up to the head of Lake George.

Another remarkable channel extends from Fort Edward to Whitehall. This is followed by the Champlain Canal, whose summit level is 142 feet above tide. This valley is about a mile in width between Fort Edward and Fort Ann, a distance of about twelve miles, and is occupied most of the way by swamps. Between these places the canal occupies a dead level. On the west side, towards Sandy Hill and Glens Falls, this is bordered by a sharp margin of sand and gravel deposits at a level of about 300 feet. The eastern side of the Fort Edward-Fort Ann valley is bounded by low slate hills flanked up to about 200 feet above tide, or fifty feet above the valley, with deposits of Champlain clay. At Dunham's Basin, two miles above Fort Edward, however, the channel divides, one branch going east of a low slate hill and entering the Hudson a few miles below Fort Edward. The sand deposits west of the valley, towards the angle of the river at Sandy Hill, are level-topped, extending about three-quarters of a mile east of the river, and occupying, at corresponding level, the inner angle inclosed by the river in the northeast corner of Saratoga county.

These sand and gravel deposits continue at an elevation of about 300 feet through Saratoga county along a belt following an irregular course west of the Hudson. The course pursued by the belt is through Moreau township, and the northwestern corner of Northumberland, thence diagonally through the center of Wilton to Saratoga Springs and Saratoga Lake. In Wilton township a line of eskers appears for several miles parallel with the Delaware and Hudson R. R. upon the northwest side. The elevation at Saratoga Springs is 322 feet. In the center of Wilton township it is slightly higher. Saratoga Lake is bordered upon the northwest side by two distinct terraces of sand and gravel of about fifty feet rise each. The lower terrace on the western side is, however, traversed north and south by two lines of swampy land and slack drainage. On the east of Saratoga Lake slate hills come down to the border.

Nearer the Hudson River, on the west side, through the towns of Northumberland, Saratoga and Stillwater, there is a continuous extension of Champlain clay, about 150 feet above the river.

Eight miles west of Glens Falls the Hudson follows a tortuous and narrow channel between the Luzerne Mountains and the Palmerstown range, which includes Mt. McGregor. There would seem to be no chance for a buried channel through this range, but the descent of the river from Palmer's Falls, just west of Luzerne Mountains, is upwards of 200 feet to Glens Falls, twelve miles distant, and from Glens Falls to Fort Edward, a further distance of about five miles, the fall is 150 feet more.

Upon examining the region south from Corinth, a remarkable passage is observed west of Mt. McGregor following in the main the upper portion of the valley of the Kayaderosseras River. For the first five miles this is occupied by numerous kames and kettle holes holding small bodies of water and very imperfectly drained to the forms the watershed the small stream running into the Kayaderosseras meanders through a shallow, broad valley occupied by horizontally stratified sand and gravel. Without doubt this was temporarily the outlet of the Hudson River during the recession of the ice sheet. I did not have time to follow this valley down to see the

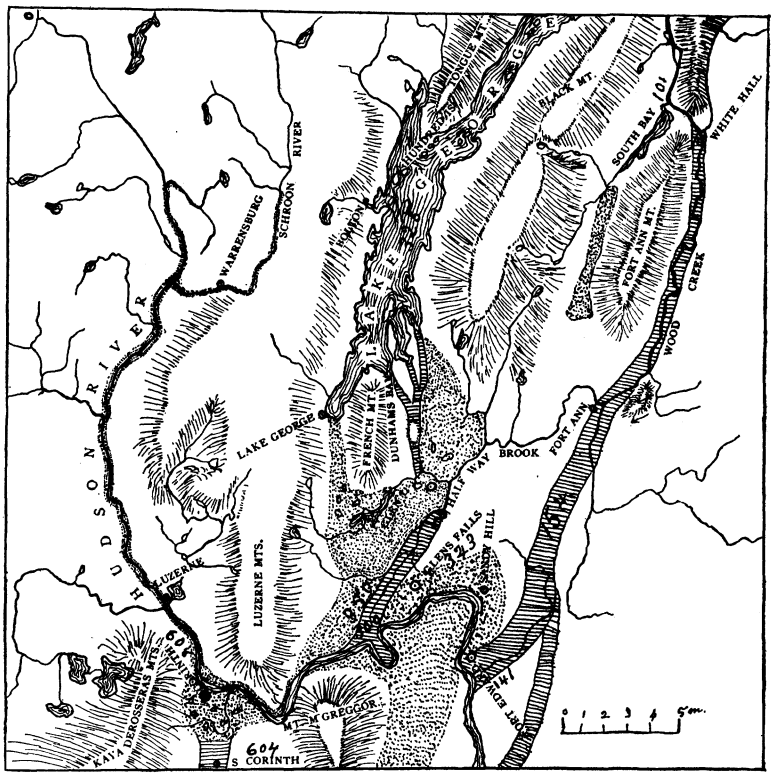

Fig. I. Dotted portion shows gravel deltas and kames. The cross ends abandoned channels. Figures, feet above tide.

northward. At South Corinth, at an elevation of 604 feet above tide, there is an extensive swamp about a mile wide, from which the water drains both ways. On the west of this swamp and stretching southward extensive deposits of gravel and sand, which may be a lateral moraine, flank the Kayaderosseras Mountains. This morainic belt is 300 or 400 feet above the valley. Immediately south of the swamp which direction and limits of the gravel deposits derived from this source. So far as I could see, there was here ample space for a preglacial channel conducting the drainage in the upper Hudson along a more direct line than that which is now followed from Corinth to Glens Falls and Fort Edward and thence southward.

At Fort Ann the channel from Fort Edward to Whitehall is nearly crossed by

Archæan rocks which rise on either side to a heighth of two or three hundred feet. Evidently there is no space here for a preglacial channel of any size, though in building the lower lock upon the canal, which here descends about twenty feet, it is said that piles were driven to a depth of one hundred feet to secure foundations. Below these locks Half-way Brook joins Wood Creek and a broad, nearly level channel extends northward to Whitehall. It appears evident that the preglacial drainage went both ways from this Archæan ridge at Fort Ann.

But, while the present drainage runs east of Fort Ann Mountain to Whitehall, the main line of the depression occupied by Lake Champlain is to be traced west of this mountain through South Bay, at the head of which there is a pronounced terminal moraine extending across the depression, which is here about a mile in width, and filling it to a heighth of from two hundred to three hundred feet with glacial debris. The summit of this moraine is reached on the north side in a distance of about one-half mile, while southward a deposit of kames and of aprons of gravel descend gradually to Half-way Brook, in the vicinity of Fort Ann, a distance of about eight miles. How deeply buried this valley may be it is impossible to tell from surface indications; though on the north side it is clearly filled in the whole depth to the level of Lake Champlain. It is by no means impossible that by removing this glacial debris there may be discovered here a feasible route for a ship canal with water running directly from Lake Champlain to the Hudson.

Lake George presents interesting glacial problems throughout its entire length. Mr. Prentiss Baldwin, whose paper on 'The Pleistocene History of the Lake Champlain Valley' (American Geologist, Vol. XIII., March, 1794) sheds a flood of light upon that region, left his notes upon Lake George unpublished. Failing to accompany me as he intended he gave me the benefit of his knowledge of the region, which had led him to surmise that the lake was held in place by morainic dams at each end, and that the preglacial drainage of the depression ran both ways, the divide being at the hundred islands between Tongue Mountain and Shelving Rock. Of this theory I was able to find abundant evidence.

The lake is 326 feet above tide and 225 above Lake Champlain, running for half its distance parallel with the Champlain and distant from it not more than four or five miles, there being between them a mountain range reaching at one point a summit of nearly 3,000 feet. The descent of the water at Ticonderoga is effected by two falls less than a mile apart; but, extending from the steamboat landing at Baldwin, there is ample space for a buried channel west of the falls; while just west of the upper fall a small stream exposes a section which shows compact glacial till filling the space down certainly to the level of the top of the lower fall. Northward from this point a well-defined depression about half a mile wide extends directly onward across Trout Brook, around Mount Hope, reaching Lake Champlain half-way between Ticonderoga and Crown Point. This depression is occupied by level-topped deposits of Champlain clay through which small streams have cut deep depressions without exposing rock. There can be little doubt that the former drainage of the north end of the Lake George depression extended by this route to Lake Champlain.

At the south end of Lake George the phenomena are equally or even still more interesting. The drainage of this part of the lake was not by Caldwell, but through Dunham's Bay to the east of French Mountain. For assistance in discovering the facts I am much indebted to Mr. Edward Eggleston,

whose residence is at the head of this bay. The three bays projecting southward from this part of the lake all end in swamps which unite together and extend a considerable distance south through a depression which is a mile or more in width, with French Mountain upon the west flanked all the way by a lateral moraine. The swamp is finally interrupted by a beautiful drumlin about 250 feet high, one mile in length, and one-third of a mile in width. This is as typical in every respect of this class of hills as any which can be found in eastern Massachusetts, its longer axis being parallel with the valley; but it is not broad enough completely to fill the valley. On either side of it the watershed occurs in low-lying swamps not more than twenty-five or fifty feet above Lake George; while to the south gravel deposits fill the whole area to Half-way Brook, not more than a mile distant. There are some of the most enormous dry kettle holes in this area that I have ever seen. It would be a very easy matter to dig a canal which would turn the water of Lake George in this direction and deprive Ticonderoga of its water power.

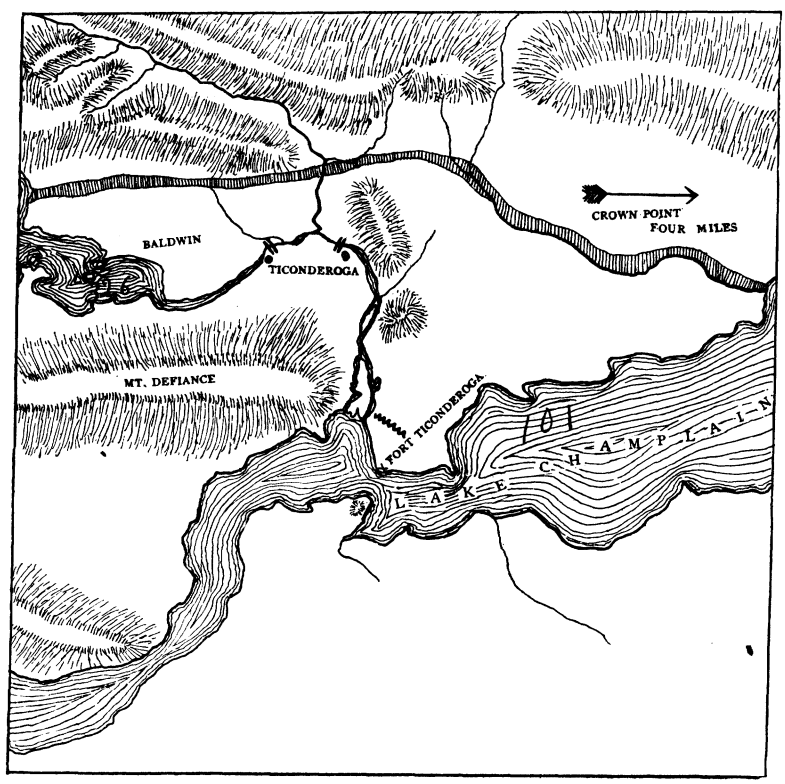

Fig. II. Preglacial channel between Lake George and Lake Champlain west of Ticonderoga.

The results of the investigations may be summarized in the following general statements:

1. The preglacial course of the Hudson was probably directly south from Corinth between Mt. McGregor and the Kayaderosseras range. This was filled up by glacial deposits at South Corinth to such a height that upon the retreat of the ice the

water was turned eastward through the narrow defiles across the Luzerne range to Glens Falls, where it found its present channel to the south.

2. The gravel deposits bordering the river east of the Luzerne range, and extending to Sandy Hill, are a true delta deposit of the Hudson when swollen by the torrents accompanying the melting of the ice over the Adirondack region during the last stages of the glacial period. The limitation of the amount of debris and the brevity of the period appear in the fact that the channel between Fort Ann and Fort Edward was not filled by gravel.

3. The gravel deposits extending through Saratoga county were made at an earlier stage of the recession, when ice occupied not only the region to the north, but the eastern part of the Hudson Valley to a considerable distance farther south. This view is supported not only by the line of eskers referred to, but by the fact that throughout this region the glacial striæ are from northeast to southwest. These are very pronounced in the vicinity of Saratoga Springs and at Fort Ann. It would seem that the retreat of the ice was from the southwest, and that the area about the mouth of the Mohawk was earlier free from ice than were the flanks of the Green Mountains north of Troy; so that during the closing stages the line of resistance for the movement of ice was diagonally across the Hudson toward the area just south of the Kayadarosseras Mountains.

4. The main line of the Champlain Valley extends southward through South Bay, while the main line of the Lake George Valley extends southward through Dunham Bay to the Hudson.

5. The subsidence of the Champlain epoch, which amounted to about 300 feet in the vicinity of Ticonderoga, was probably not much less in the vicinity of Fort Edward; for it seems evident that the delta of the Hudson River, which came down at Sandy Hill to the border of the Fort Edward-Fort Ann channel, must there have met still water nearly up to its level of 300 feet. The deposits of sand were sharply limited by deep water, while the clay had ample opportunity to settle over all the areas along the Hudson up to a height of from 200 to 250 feet above tide.

6. There is nothing in this region which indicates a post-glacial depression of more than 300 feet, but everything to indicate the opposite. All the gravel deposits above that level are of the nature of eskers and kames.

7. The preglacial watershed between the St. Lawrence and the Hudson was probably near the middle of Lake George and at Fort Ann.

G. F. Wright.
Oberlin, O.

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*THE EARLY SEGREGATION OF FRESH-WATER TYPES.**

Dr. Gill prefaced his communication with the statement that it was a familiar fact that some of the most primitive types of animals were represented in the fresh-waters and in them only; this is especially the case with true fishes. It is also well known that fresh-water animals show all degrees of relationship to salt-water forms, ranging from species that are anadromous or catadromous to those that are representatives of families or groups of families confined to the fresh water. But it has not been appreciated how radically a large proportion of the fresh-water fauna has been differentiated from the marine. The perception of the extent of this differentiation has been delayed by the false taxonomic principles that have long prevailed. A typical instance of the truth of this proposition is furnished by the Ostariophysial

*Abstract of a paper presented by Dr. Theo. Gill before the meeting of The National Academy of Sciences, Philadelphia, October 30th.

fishes. This great group includes nearly two-thirds of all fresh-water fishes and comprises the Characinids of America and Africa, the Gymnotids of America, the Cyprinids of the northern hemisphere and the various families of Nematognaths. These groups, in most systematic works, have been widely separated and severally associated with forms with which they have no intimate relationships. As long as such views prevailed, the appreciation of the great importance of the geographical distribution of the groups was concealed from view. But with the recognition of the unity of organization, and, consequently, unity of origin of the whole, a fresh conception of the relations of that whole to the faunas of the present and past breaks in upon us. We are now justified, from the morphological data at hand, in claiming that all the groups enumerated as OSTARIOPHYSI and belonging to the orders PLECTOSPONDYLI and NEMATOGNATHI are naturally segregated and not closely related to any existing aboriginal marine types. The marine forms of the family *Plotosidæ* and the siluroid sub-family *Tachisurinæ* must be regarded as divergents from fresh-water forms. With this assumption it becomes necessary to postulate that all the numerous families of the Plectospondylous and Nematognathous orders are derivatives from primitive fresh-water types. The extent of this divergence may be inferred from the numerous morphological modifications. The antiquity of the origin of the superorder must be commensurate with the extent of divergence. Far from originating in the advanced tertiary, it is not unreasonable to infer that the parent stock had become acclimatized in the fresh water as far back as the early mesozoic; instead of the parent land being the Himalaya region or highlands of Asia, as claimed by Dr. Günther, it is much more likely to have been in the southern hemisphere—possibly an antarctic continent. At any rate, the present geographical distribution of the representatives of the respective orders seems to render such an origin most probable. The reasons were given in detail.

The distribution of the group thus outlined is to some extent collateral with that of certain mollusks and crustaceans, and the facts respecting the range of the unionaceous bivalves and the ostracod crustaceans were especially discussed.

It is quite true that there is no paleontological evidence for the inferences and assumptions thus made, but this is simply because the geological record is wofully imperfect and many of the changes took place in continental areas now submerged or little explored. No remains of Ceratodontids, which must of course have lived to continue the line from the Jurassic species to the present, have been found. The same conditions that have affected the one must have prevailed for the others.

DRY DREDGING IN THE MISSISSIPPIAN SEA.

THE U. S. National Museum has recently secured large collections of Devonian fossils, chiefly corals, from New York, Ontario and Michigan. The first casts were made in the Corniferous limestone in the vicinity of LeRoy, New York, where the cherty limestone underlying the quarry layers is charged with an abundance of corals, the net sometimes having masses of *Diphyphyllum* of more than a hundred pounds weight. At Williamsville, near Buffalo, corals are also plentiful, but here the fauna is smaller and the species are not so common as at LeRoy. However, a short distance west of Buffalo, to the north and west of Port Colborne, in Ontario, well-preserved Corniferous corals are present in great variety and abundance. Also at Hagersville, large masses of various compound species are numerous, many hundred tons of which, two years ago, were broken up

and used for road making. At all the localities mentioned, except Williamsville, the corals are in a siliceous pseudomorphous condition; *i. e.*, the original carbonate of lime has been replaced by amorphous silica. The surrounding limestone being so much softer, on weathering it decomposes far more rapidly than the included chert bands and corals, and leaves them lying loose in the soil or among the flakes of chert thrown up by the farmer's plow. Collecting places are usually easily discovered, since outcrops of the Corniferous limestone are generally indicated by stone walls surrounding the farms or by stone piles scattered over them. Four miles west of Port Colborne, at one of Prof. Nicholson's localities, there is a rock pile more than fifteen feet high, every piece of which contains corals or mollusca. At such places, one is interested often for days in turning over the rocks and selecting the better specimens, all of which can, if necessary, be further developed with dilute hydrochloric acid.

Towards the western portion of Ontario, at Thedford, the next younger, or Hamilton, formation is well exposed, and here again corals are very abundant. This locality is probably the most famous for Middle Devonian fossils in North America, and visiting collectors will find themselves pleasantly surrounded with people who understand that a collector of fossils is neither a curio collector nor insane. It is painful to have the same question asked many times each day: "Mister, what are you looking for?" and after one has explained, to observe in the listener no comprehension of the first principles of geology, or, worse, to be told: "I suppose you take them home and gild them." But at Thedford one is either left alone or assisted to find localities, or, better still, allowed to collect in the cabinets of the minister, teacher, storekeeper, tailor, or section boss. What a splendid place Thedford is to the collector of fossils can be surmised on stating that from one to five thousand specimens of the brachiopod *Spirifer mucronatus* can be picked up in a day. Thedford, formerly known as Widder, is made famous by the writings of Billings, Hall and Whiteaves, and is visited annually by collectors. Sometimes a college professor turns up with a car load of students, including ladies. The local enthusiasm, however, has been developed by the intelligent efforts of Rev. Hector Currie, who, in a village of less than one thousand inhabitants, is surrounded by four enthusiastic collectors.

The Hamilton formation is again observed on both sides of the southern peninsula of Michigan, near its northern extremity. Thunder Bay Island, situated twelve miles east of Alpena, is almost one mass of the coral-like *Stromatopora*, growing in thin concentric layers one upon another, until single colonies assume a diameter of from a few feet to the great width of three yards. Upon these the sea of Lake Huron has been pounding for ages, weathering away the top of each wavy dome and separating the colony into innumerable, concentric, fractured layers. In a general way, each mass resembles a transverse segment of a huge tree trunk, and is often taken for such by the local life-saving crew. In the quarries north of Alpena, layers of limestone nearly barren of fossils and less than ten feet thick are seen to increase rapidly to a thickness of nearly twenty feet toward the coral reef, which is built up by *Stromatoporæ*, large *Acervulariæ*, numerous compound branching corals, and here and there a shell or the beautiful calyx of a crinoid. Petoskey, on Lake Michigan, is another well-known Devonian locality, and is famous not only as a summer resort for hay-fever sufferers, but for the 'Petoskey stone' as well. This stone is usually a polished fragment of the coral *Acervularia davidsoni* or of *Favosites alpenensis*, and local

curio dealers search for them in a novel manner. This is done by sprinkling with water the pebbles on the beach of Little Traverse Bay. By the temporary polish thus produced, the dealers are enabled to gather the Petoskey stone in a nearly marketable condition for tourists.

CHARLES SCHUCHERT.
U. S. NATIONAL MUSEUM.

ANTIDROMIC PROBLEMS.

IN my paper on Antidromy* I have tried to show: (1) that there is a diversity among the individuals of every species of flowering plants, some with a tendency to dextrorse, others to sinistrorse twisting; (2) that this can be traced more or less through the different orders of plants, in the seeds, stem, phyllotaxy, anthotaxy and seed vessels; (3) that it is apparently caused in most cases by the place of origin of the anules on the right or left margin of a carpellary leaf.

The general evidence for this view is to be found at large; and without going into details, I may say that further observations confirm the conclusions first reached. The article by Professor Beal in the *American Naturalist*, 1873, with interesting notes on two kinds of spirality in the cones of the same trees of the Coniferæ, presented a difficulty when first called to my notice; but I find that the young cones are homodromic with each other and with the leaf-spirals of the Coniferous trees, whilst the older cones undergo a change by displacement of the scales, resulting in a false antidromy in the same tree. On growing maize-plants from grains taken from one column of an ear, the forthcoming plants are of different kinds. (This is to correct the statement in my former paper.)

I have not yet been able to extend the law into the higher cryptogams; though some things in ferns make me hopeful of succeeding with them, as also some of the illustrations in Schimper's Vegetable Paleontology and in other books. A few illustrations in the books are, I think, erroneous; thus Engler and Prantl give *Helicteres* (Sterculiaceæ) and with carpels *antidromic on the same plant.* I think this will be found erroneous, as I know the same work is wrong in the figure of *Erodium*, whose fruit-beaks are all and in all plants dextrorsely twisted (that is in the direction of the thread of a screw); as are those in Pelargonium. The carpels of these do not appear to be antidromic (though the leaves are so) as between different plants; and in *Impatiens*, of the same order, both carpels and leaves are antidromic. Sachs' *Botany* gives a figure with a wrong spiral for the elaters of *Equisetum* (and I confess my own sin here); they run dextrorsely in all the plants.

The spirals of the oogonium of *Chara* are always sinistrally twisted, given wrong in Dodel-port's diagram. The peristome of Barbula and other mosses, if twisted, is usually dextrorse, and the seta in opposite directions (didromic) in its upper and lower parts. I think the inner peristome of Buxbaumia is sinistrorse. The anchoring cable of *Vallisneria* is didromic, twisted dextrorsely above and sinistrorsely below, so as to bring the two ends nearer together by a central turning. The same is true of the awns of *Stipa*, *Danthonia*, and many other grasses; the base being a dextrally twined ribbon and the tip a sinistrorse seta; when it is wet the basal ribbon unwinds so as to screw the seta into the earth as into the wool of sheep or the clothing and skin of men, as Captain Cook's seamen discovered in the last century in northeastern Australia. These are cases not of true Antidromy, but of Didromy, a double twist in the same organ.

As mentioned in my former paper, *Richardia*, *Iris* and *Juncus* appear to produce antidromic plants not merely by seeds, but by

* Torrey Bulletin, September, 1895.

division of the rootstalk. A still more difficult case is the Bilsted (*Liquidambar styraciflua*). This tree can change its phyllotaxy with its branching; it may divide at the ground, sending up two stems, both of the same or of antidromic phyllotaxy; each stem may produce branches of both kinds, and the branches may bear secondary branches of their own or different spirality. Within any one branch, the phyllotaxy is definite, at $\frac{2}{5}$ divergence, one way or the other, for the bud scales of the annual innovations, as well as for all the leaves; and the order does not change within a branch, but between a branch and its sub-branches the order may or may not change. On the upper surface of the horizontal branches are the cork ridges which curve (irregularly) to right or left in harmony with the phyllotaxy of that branch.

The only explanation that occurs to me as possible is that Bilsted may have a latent tendency to produce both orders of phyllotaxy, that some slight inequality of nutriment may determine which shall start first, and that whichever gets the start is able to retain the preponderance for the particular branch, and the same influence is felt by the cortical growth. But the severe strictures of Sachs (*History of Botany*) on the old literature of phyllotaxy is a wholesome caution not to be speculating beyond the evidence; his criticism, however, is directed against theories invented by mathematicians, and not against those that would arise from a consideration of the plant's ontogeny.

G. Macloskie.
Princeton College, October 25, 1895.

TYPHOID FEVER DISSEMINATED THROUGH THE MILK SUPPLY.

The relation of milk to the spread of infectious diseases has been most strikingly shown in an epidemic of typhoid fever that occurred at Stamford, Conn., during this year, the official report of which has been recently issued by Prof. H. E. Smith. The evidence gathered shows beyond all question that the the disease was propagated by means of the milk supply, so that the epidemic possesses unusual interest for students in bacteriology and hygiene.

The epidemic broke out in April, and within six weeks 386 cases were reported in a town of about 16,000 inhabitants. Of this number, 65 cases or 16.8% were five years old or under, while over one-third of the total number were under ten years of age.

The mortality statistics of the State of Connecticut for the last 15 years show that less than 10% of the total number of deaths from typhoid have been under 10 years of age. In view of this, the large number of cases in early childhood has a peculiar significance in explaining the origin of the epidemic, as the infection of the milk supply would be more apt to manifest itself in infants than in adults. As soon as the milk supply was suspected, its sale was prohibited, and in fifteen days (about the usual period of incubation of this disease) after this prohibition went into effect the number of new cases dropped from an average of over ten a day to less than two. It was further shown that out of the total number of 386 cases, 352 or 91.2% lived in families that were supplied with milk from the same dealer. In 14 other cases milk from this same dealer was consumed by parties at a café and bakery. In 8 of the remaining cases milk was supplied the parties by the producer from whom the milk peddler obtained his supply. This makes a total of 97.1% of all cases that received the milk, either directly from the producer or indirectly through the milk dealer who peddled the milk. As the milkman in question only supplied about 9% of the total amount used in the town, the number of cases that developed on his route is of especial interest.

The evidence of a contaminated milk supply was overwhelming, but how to account

for the infection of the milk was not so easy. The milk might have become infected in the hands of either the dealer or the producer. Inasmuch as a few cases of the epidemic developed that were not supplied with milk from the dealer, but were supplied by other parties that had been using some of the milk cans in common with him, the presumption was strongly in favor of the view that the infection occurred while the milk was in the hands of the dealer. It seems that the dealer was in the habit of washing out his cans himself, and, while he obtained most of his supply from the producer in question, at times he secured an extra supply from other parties. No particular attention was paid to the cans that were used, so that they were often mixed up and returned to different parties after they had been cleaned by the dealer.

No case of typhoid had occurred at the house of either the dealer or the producer, so that direct infection of the milk did not seem probable. An examination of the water supply was then made. At both places shallow wells were found, that of the milk dealer's being only thirteen feet deep with nearly twelve feet of water in it. The well was surrounded on several sides by privies, an extremely foul one being within twenty-five feet of the well. It was the habit of the dealer to first rinse out the milk cans with water from this well, then they were thoroughly cleansed with hot water and soda, and finally *rinsed in cold water again that was taken from this well.*

Both the bacteriological and chemical examination of water from the two wells was made.

Neither of the wells were good and that of the milk dealer was grossly contaminated, having nearly 70,000 germs per cubic centimeter.

Typhoid bacteria were not discovered, but this is not surprising. It is possible that the privy near the well may have been used by some unknown person, as it was close to and easily accessible from a railroad. There is no positive evidence, however, that the water was contaminated except in the history of the epidemic. The evidence, however, is so strong that there can be no valid objection to the conclusion that milk was infected by washing the cans with contaminated water.

H. L. RUSSELL.

MADISON, WIS.

ELEVENTH INTERNATIONAL CONGRESS OF AMERICANISTS.

ON the fourteenth of October, in the beautiful Salón de Actos de la Escuela Preparitoria in the City of Mexico, was inaugurated a scientific meeting, not only memorable for our great sister Republic, but in many respects unique and *sui generis.*

Though to the official proceedings in Spanish reference must be made for an authoritative account of the mature work submitted to this august assemblage, yet the readers of SCIENCE may not be uninterested in a few words about the external and social aspects of the Congress.

The preliminary session on October 14th was remarkably well attended and was stamped by an air of elegance, distinction, prestige, which is by no means noticeable at our own science meetings.

The Cabinet Ministers of Mexico, the Ministers of the Great Powers of Europe and America, the Governors of the Mexican States, mingled with the men of science, made an array which we could not duplicate outside of Washington. The roll of the delegates was called, and each one presented his credentials, which were then scrutinized.

In accordance with Mexican social etiquette, the President of the Republic, Porfirio Diaz, was debarred from being present because of the recent death of his father-in-law, Romero Rubio.

The Congress, to express its respectful regrets in this matter to President Diaz, appointed a special commission of four, el Excelentisimo Sr. D. Justo Zaragoza, a delegate from Spain, Dr. George Bruce Halsted, a delegate from the United States, and two delegates from Mexico.

This commission visited the President in the National Palace, and to its brief address, prepared and delivered by the chairman, an appreciative answer was returned, and both were read in the next general session of the Congress. This session began at 4 o'clock on October 15th, in the same hall, once the chapel of the oldest university on this continent, San Ildefonso, now modestly called Escuela Preparatoria, though the people cling to the old name.

Sr. Julio Zárate read the minutes of the preceding meeting, and then the general secretary, Sr. Trinidad Sánchez Santos, read an account of the work of organization, which began last April.

At 21 of the 23 meetings of 'la junta organizadora' Sr. Lic. Joaquin Baranda, Secretary of Justice and Public Instruction, presided.

This may give some hint of how much the Congress owes to this truly enlightened man, founder also of the Anthropological Museum, which for its age is unsurpassed. The junta sent special invitations to eminent scientists.

From special gifts and offerings of men of science the junta made a highly valuable collection, particularly important for the study of the pre-Columbian period in America.

With the object of itself making a worthy contribution, the junta had translated twenty-seven of a precious collection of songs of the aborigines found in a MS. of the Biblioteca Nacional. Arrangements were made for an excursion of the delegates to visit the ruins of Teotihuacan and Mitla, those worthy monuments of antiquity.

Following this reading, the President of the Congress, Joaquin Baranda, occupied 'la tribuna.' He praised the Congress at Stockholm for determining, in accordance with true scientific method, to meet in Mexico and study at first hand, objectively, the monuments of American antiquity. He enumerated with erudition the archæological treasures of Mexico, from the northern frontier to Yucatan, and especially those in and immediately about the beautiful capital. He referred to the Calendar Stone, reflection of the astronomical acquirements of the Aztecs and the celebrated Cross of Palenque, mysterious sculpture of the Mayas, a seeming prophecy of Christianity, though long before Christ.

He spoke of the codices, maps, records of tribute to the antique monarchs, now being studied with more enthusiasm than ever before. He spoke of Humboldt, from the peak of Chimborazo enveloping America in that profound regard which made him her scientific discoverer. He finished by welcoming the delegates in the name of the people and the National Goverment, which rejoices to aid whatever signifies progress.

Sr. Lic. Ignacio Mariscal, secretario de relaciones exteriores, in the name of the President of the Republic, then declared the Congress open.

That evening at 8 o'clock a banquet was given by the City Council to the Americanists in the Municipal Palace. There were 200 guests, and the newspapers stated the cost of the banquet at six thousand dollars.

The whole floor from the very entrance was carpeted and heavily strewn with natural cut flowers, on which the guests trod. The records of this City Council date back to 1524, the first minutes being signed by Hernan Cortes, the 'conquistador.' Electricity, gas and wax made a blended light in the beautiful dining hall. The floral decorations were, of course, superb.

The first after-dinner speech was by Sr.

Sebastian Camacho, Mayor of the city, an elaborate eulogy of science and welcome to the Americanists in the name of the city.

The President of the Congress responded.

Alfredo Chavero, author of that rare tome, 'Mexico a traves de los Sieglos,' followed with a toast to the three historians of Mexico—Fernando Romirez, Manuel Orozco y Berra and Joaquin Garcia Icazbalceta.

Dr. Edward Seler, of the University of Berlin, the greatest of all Americanists, spoke in Spanish, maintaining that the civilization of the ancient nations of Mexico was wholly indigenous. When this charming and absolutely unaffected scientist hesitated for a Spanish word, and nervously moved about the seven wine glasses in front of him, his wife, sitting opposite, the only woman at the banquet, herself a brilliant Americanist, suffered feminine tortures for her husband, all unnecessarily, for his speech was the greatest success of the evening, and applauded to the echo.

Dr. Antonio Peñafiel, the most respected of Mexican archæologists, spoke of the earlier historians, Clavigero, Cavo, Veytia and others.

The academician of Spain, Justo Zaragoza spoke of how peace and prosperity under President Diaz had prospered research into Mexico's remote past.

Just after the formal adjournment, Governor Próspero Cahuantzi, a gigantic pure Indian, gave in the Aztec language a speech seemingly eloquent, to which Dr. Seler gave intense attention and in part understood.

At ten next morning, October 16th, the Congress visited the wonderfully rich National Museum. Besides a new catalogue of the Department of Archæology, five other new catalogues had been prepared for the visit of the Congress and were presented to all wearing the badge of 'Americanistas.' Num. 1, Catálogo de la Coleccion de Mamiferos del Museo Nacional, segunda edicion; Num. 2. Coleccion de Aves; Num. 3. de Reptiles, were by Alfonso L. Herrera, to whom a prize was lately awarded by our Smithsonian Institution.

The highly creditable Num. 4. Catálogo de la Coleccion de Antropologia del Museo Nacional, 164 pages, with tables, was by Alfonso L. Herrera and Ricardo E. Cicero. The 'Guia para visitar los salones de Historia de México del Museo Nacional' was by Jesus Galindo.

The display lent by the State of Vera Cruz, and the recently discovered colored pictorial ancient manuscripts attracted great attention.

One of these, in depicting the deliberate shooting with arrows of captives bound to a ladder, smacked strongly of the stories of our own 'Indios bravos.'

The rampant cannibalism of the interesting aborignes also came out strongly.

At 4.10 in the University the session was opened by a reading of the minutes, and then the 'Chicomostoc Memoirs,' by L. Amador, of Zacatecas, were read by Roman S. de Lascurain. A paper on the conditions of commerce, money and exchange between the towns of antique Mexico, by J. W. Bastow, was read by J. Breaux.

A discussion about Toltec and Aztec idioms was started between Dr. Seler and Sr. Leopoldo Batres, conservator of public monuments, in which discussion of course Sr. Batres had no chance.

At ten o'clock the next morning, October 17th, the Americanists visited the 'Escuela de Bellas Artes,' whose genial director, besides his Spanish, is fluent in English and German. Each member of the Congress was presented with a specially prepared treatise on Mexican Art, of the very highest interest and value.

At four o'clock the regular sessions were continued.

At eight o'clock on the morning of Oc-

tober 18th an excursion to Popotla was made by wagons, starting from 'la Plaza de la Constitución,' opposite the 'Portal de Mercaderes.'

This was chiefly a visit 'al árbol de la Noche Triste,' the famous tree against which Cortes rested and wept on the night of his terrible defeat. The tree, unfortunately, seems dying, but its tremendous trunk, a wooden tower, may still be a landmark for centuries.

The tree of Montezuma, at the back of Chapultepec, is still flourishing, one the grandest and most impressive of living things on this earth.

At ten o'clock a visit was made to 'la Escuela Nacional de Ingenieros,' where is perhaps the greatest collection of large meteorites in the world.

At four o'clock again in session in the Escuela Prepartoria.

But already we have followed long enough to give an insight into the life of this most enjoyable Congress, and while the fortunate Americanistas go south by rail to Oaxaca, thence to ride to Mitla, digging in the prehistoric past, we face again the unsoftened raw newness of our own United States.

George Bruce Halsted.
Austin, Texas.

RECENT INVESTIGATIONS UPON THE EMBRYOLOGY AND PATHOLOGY OF TEETH.

The embryonic development of the teeth is now a subject of most active investigation, and we are constantly receiving new communications from Leche, in Stockholm; Kükenthal, in Jena, and Röse, in Freiburg. The most striking discovery is that of the existence throughout the mammalia of remnants of two series of teeth, preceding the milk and permanent series. The teeth represented in these two series are entirely vestigial; both precede the embryonic development of the milk teeth, and are indicated merely by indentations of the dental fold. So far as known, these germs never develop enamel, but they constitute the most positive evidence of the derivation of the mammalia from reptilian or amphibian ancestors with a multiple dental succession. These 'prelacteal' teeth, as they are called, were first observed by Leche, in 1892, in certain Insectivora, but they have subsequently been found among the Marsupialia and in the seals. Röse has now found unmistakable vestiges of these teeth in the human jaw. Man, therefore, in common with many other mammals has four sets of teeth, instead of two as formerly supposed.

Röse's investigations upon the teeth of Amphibia Reptilia and fishes demonstrate conclusively the truth of Hertwig's theory that teeth are modified scales which have passed into the mouth cavity. He finds that the rudiments of the first series of teeth in each of these types develop exactly after the manner of the placoid dermal scale. The second series of teeth develop after an intermediate type, and it is only the third series of teeth which develop from the typical dental fold lying suspended within the mesoblast, or lower tissue of that layer. Dr. Röse, with Prof. Kükenthal, of Jena, has been the most active supporter of the theory of the origin of complex tooth crowns by concrescence of primitively separate cusps, and this 'concrescence theory' has spread very rapidly in Germany as an explanation of the mode of origin of the elaborate tooth forms. There are very slight grounds of evidence for it among the mammalia; in fishes, however, it has long appeared probable that the well-known type of shark tooth (*Lamna*), consisting of three cusps united at the base, so abundantly found in the phosphate beds of South Carolina, represents a concrescence. Röse has now made a very careful study of the tooth development of *Chlamydoselachus anguineus*, Garman, and finds conclusive evidence that the com-

pound crowns of this type are formed by the concrescence of three separate denticles.

Dr. Carl Röse has also completed a most valuable investigation upon the causes of the decay of teeth. (*'Ueber die Zahnverderbniss in den Volksschulen.'*) With the aid of two colleagues, in the schools of Freiburg and the Black Forest he has examined 7,364 children and 179,087 teeth. Special objects of the investigation were the relations of dental caries to the geology of the country, and the presence of a greater or less amount of lime salts in the water, and, secondly, the influences of the consumption of different kinds of farinaceous food. In general the use of water or food poor in lime salts affects the development of the teeth very unfavorably; and the use, especially, of fine milled white bread is very prejudicial to sound teeth, whereas the use of the common black bread keeps the teeth clean and the gums in a healthy condition. As regards stratigraphy the investigation shows that as we pass from granitic to overlying calcareous formations there is a steady decrease in the number of unsound teeth—falling from 35.3 to 16.1%. These figures are taken without regard to the character of the bread and other food consumed by the children and show exclusively the influence of water. The conclusion is that the worst teeth of the calcareous districts are always better than the very best teeth found within the non-calcareous districts, the degeneration of the teeth being indicated by a yellowish white and bluish gray color.

In the matter of food, meat is a great luxury among the peasant children, enjoyed, if at all, only upon Sundays, and can be left entirely out of account. Dr. Röse finds that the consumption of the German 'Kuchen' (made of white flour with milk, butter or oil and more or less sugar, raisins, etc.) is very prejudicial to the teeth; and, in fact, the very worst teeth are regularly found within those districts where these cakes are habitually consumed. The conclusion as to food is that the very best form of foods, so far as teeth are concerned, is the black bread with its coarse, thick crust. The investigation extends to the relation between the general condition of the mouth and gums and epidemics of diseases such as diphtheria, which principally affect children, and Dr. Röse maintains that there is a direct relation between the unhealthy condition of the teeth and gums and a predisposition to epidemic diseases. He believes that in times of epidemics these disease germs are found in the mouths of nearly all children and that a healthy condition of the mouth resists the infectious power of the germ. As regards sex, there is very little difference between the boys and girls in the matter of decay. It is an interesting point that the development of the teeth is very much more rapid in girls than in boys, so that in children of the same age a much larger proportion of milk teeth are found among boys than among girls.

The article closes with a strong appeal for the education of children in the schools in the proper care and protection of the teeth, and the author recommends not only the careful instruction of children in this respect, but also the award of prizes.

H. F. O.

CURRENT NOTES ON PHYSIOGRAPHY.

THE MARGINAL PLAIN OF CHINA.

SKERTCHLY AND KINGSMILL describe 'the loess and other superficial deposits of Shantung, North China' (Quart. Journ. Geol. Soc., London, li, 1895, 238–253), recognizing the alluvial delta plains of the great rivers, a plain of marine sands, and a somewhat denuded lowland of loess. The delta of the Yangtse is estimated to increase by two square miles a year. The sandy marine plain is broadly developed over a bay-like area up the Yellow River,

back of its delta. The surface of the loess is diversified by valleys of denudation. This peculiar formation is explained as consisting neither of glacial flour nor æolian deposits; it is 'plainly stratified,' certainly of aqueous and probably of marine origin; but in the discussion following the reading of the essay the latter conclusion was disputed by several geologists present at the meeting. The outer margin of the loess lowland is an old, rounded sea cliff, with headlands and bays, overlooking the uniform level of the delta; but details of this interesting geographical feature are unfortunately not given.

RIVER VALLEYS OF THE HIMALAYAS.

THE occurrence of the chief water parting back of the highest range of the Himalayas has called forth various explanations, to which R. D. Oldham, Superintendent, Geological Survey of India, adds another (Jl. Manchester Geogr. Soc., ix, 1894, 112–125). He suggests that the south-flowing rivers have extended their headwaters backward through the main range, by reason of their great slope in comparison with the rivers that flow northwards from the mountains to the elevated table-lands of Thibet. The contrasted river slopes on the two sides of the present main divide are illustrated by a well drawn section. The author points out that the divides thus shifted away from the axis of the range always provide low passes through the mountains, because the former high slopes of the axial divide have been obliterated. [Heim describes terrace-like remnants of the upper parts of beheaded valleys in cases of this kind in the Alps, overlooking the deepened valley of the beheading stream; but no mention of these details is made by Oldham.] The larger rivers are thought to be antecedent to the out ranges of the Himalayas, across which they have cut profound gorges; but it is suggested that the heavy alluvial deposits in the inner valleys were formed while the uplift of the outer range decreased the grade and the activity of the rivers.

ORIGIN OF THE VALLEY OF THE RHONE.

THE geological changes which have preceded and led up to the existing structure of the valley of the Rhone are traced by Depéret, of Lyons (Aperçu sur la structure générale et l'histoire de la formation de la vallée du Rhône, Ann. de Géogr., Paris, iv., 1895, 432–452, two maps). The theme is an interesting one, and its treatment appears to be thoroughly competent in a geological sense; but although published in the most scientific of French geographical journals under the heading of *Géographie régionale*, the essay appears to us to lack the essential quality of geographical matter, inasmuch as the sequence of geological changes in the order of time, and not the development of existing superficial forms, constitutes its chief object. Anything that will throw light on existing forms contributes to their recognition and may be properly included under physiographical geography. No collateral study gives more assistance of this kind than geology, from which a knowledge of the structure of a land mass and of the processes at work upon it are derived; but structure and process must be studied strictly in relation to the forms sculptured by their interaction, if the study is to have a geographical flavor; and not simply in relation to their order of occurrence, for then the flavor is wholly geological. The first step in the study of form as dependent on structure and process is a thorough knowledge of local geology; this being already acquired and presented for the valley of the Rhone in the above-named essay, we hope that the learned author will now take the next step and describe the regional geography of the valley.

W. M. DAVIS.

HARVARD UNIVERSITY.

SCIENTIFIC NOTES AND NEWS.

THE State Board to select a new magazine rifle for the National Guard of the State of New York organized at Albany, Tuesday, November 12th, Col. A. D. Shaw, of Watertown, in the chair. The other members are Professor R. H. Thurston, of Ithaca, and Mr. E. W. Bliss, of Brooklyn. Mr. H. E. Abell, of Brooklyn, was made secretary to the board. After consultation with Governor Morton and the Adjutant General's office, it was determined to notify inventors that they would be allowed until December 15th to present arms for examination and test at the office of Adjutant General of the State. Only American inventions can be accepted for examination. All tests are to be made at the State Camp at Peekskill. The purchase of 15,000 guns is authorized at a price not to exceed, for guns and accessories, $20 each. Aside from the construction and action of the lock and repeating mechanism and the behavior of the gun in action, it is expected that the question of varying the calibre from that of the U. S. Army, and that of interchangeability in other respects with the army gun, will be carefully studied.

A BILL has been introduced into the Congress of Mexico empowering Marshal Saville, the agent of the American Museum of Natural History, in New York, to make archæological excavations in Mexico. The bill provides that half of the objects secured shall be the property of the museum, and is said to have the approval of President Diaz.

PROF. FREDERICK STARR, of the University of Chicago, will go in December to Guadalajara, Mex., to study a submerged city in Lake Chapala, and the mountain dwarfs inhabiting the mountains near by. His intention is to try to determine whether these people are racially small or have become so by disease.

A PETITION praying the Royal College of Physicians, of London, to admit women to examinations and diplomas was the subject of an interesting debate before the *Comitia* on October 24th. The petition was rejected by fifty-nine votes to fifty. Eighteen years ago the same question was debated in the College, and the admission of women was rejected by sixty-eight votes to sixteen.

M. PERROTIN described before the Paris Academy of Sciences, on October 28th, the new observatory on the summit of Mounier, in the Maritime Alps. The observatory was planned by M. Bischoffsheim as an annex to the Nice observatory and is at an altitude of 2,741 m. In addition to a stone house for the astronomer and his assistant, there is a revolving dome, 8 m. in diameter, in which is mounted a 38 cm. equatorial telescope. A meteorological station has been organized in conjunction with the observatory. The observatory is connected by telephone with the village of Beuil, 8 km. distant.

THE Conseil Municipal of Arbois, the birthplace of Pasteur, has decided to erect a statue to his memory, and that henceforth the municipal college shall be called the Pasteur College.

THE first number of a new quarterly journal, '*Terrestrial Magnetism*,' is announced for January, 1896. It will be edited by Dr. L. A. Bauer, of the University of Chicago, with the coöperation of the leading students in America and Europe of terrestrial magnetism and allied subjects.

FRIEDRICH VIEWEG UND SOHN, Brunswick, have issued a list of their scientific publications which can doubtless be obtained on application to them. The catalogue extends to one hundred pages, and includes a large number of important works in the natural and physical sciences.

PROF. CHARLES S. MINOT, according to the *American Naturalist*, will give a special

course in vertebrate or human embryology at the Harvard Medical School. The course will run through two terms and is arranged for morphologists, anatomists and general practitioners who may wish to devote themselves chiefly to the study of these subjects for that length of time. The facilities offered by the Embryological Laboratory are unusually favorable both for the purposes of general study and of special research. Especial stress will be laid on laboratory work. The course will cover the whole field of embryology, "including the genital products, the theories of heredity and sex, the formation of the germ-layers, differentiation of the organs, the history of the placenta and the general morphology of vertebrates and of man."

A business meeting of the Scientific Association of the Johns Hopkins University was held on October 17th, at which the following officers were elected for the current academic year: Ira Remsen, *President;* Wm. H. Howell, *Vice-President;* Charles L. Poor, *Secretary.*

The Botanical Gardens of the University of Berlin are too small for the present requirements and will probably be removed to Dahlem, where some 125 acres will be provided. It is, however, feared that the distance of the Gardens from the other departments of the University will prevent their use by those who are not special students of botany. A Pharmaceutical Laboratory will be built at the Gardens.

The new Museum of Toronto University was opened to the public for the first time on November 15th.

A reception was given to Lieut. Peary by the American Geographical Society and the American Museum of Natural History on November 14th, in the lecture hall of the Museum. Addresses were made by Lieut. Peary and Judge Daly.

A cablegram has been received from Dr. Donaldson Smith announcing his safe return from his expedition in eastern Africa, where he has been engaged in explorations during the past eighteen months.

Prof. George Lawson, a writer on chemistry and botany, and professor of these subjects in Dalhousie's College for thirty years, died at Halifax on November 10th.

Climate and Health for August gives the following vital statistics for the five weeks ending August 31st: In a population averaging 13,174,361, there were 25,746 deaths representing a death rate of 20.3 per thousand per annum. The mortality of infants under one year of age 33.3 per cent. of the total mortality and that of children between one and five years of age 14.2 per cent.

Experiments are about to be undertaken by the Agricultural and Electrical Departments of the University of California to determine the feasibility of destroying phylloxera by electricity. It is hoped to succeed in doing this without injuring the vines.

In addition to the regular courses given at Johns Hopkins University by Prof. William B. Clark and Dr. E. B. Matthews and Dr. R. M. Bagg, the following lectures have been arranged: Sir Archibald Geikie, Director General of the Geological Survey of Great Britain and Ireland, has accepted the invitation of the President and Board of Trustees to inaugurate the George Huntington Williams Memorial Lectureship, and has selected October, 1896, as the time for delivering his lectures. Mr. G. K. Gilbert will begin a course of lectures on Physiographic Geology the second week in January, and will lecture four times weekly until about the end of February. This course embraces a discussion of the origin of the forms of the earth's surface, and its treatment will include the systematic presentation of a large body of the principles of dynamic geology, especially those which apply to

the sculpture of the land by the various processes of erosion. The lectures will be illustrated by maps, models and lantern views. Mr. Bailey Willis will lecture twice a week during the months of March, April and May on Stratigraphic and Structural Geology. This course will consist of a description of the processes which result in the formation and upheaval of sedimentary rocks, and will lead to a discussion of the principles which should govern interpretation of the sedimentary record. In connection with these lectures Professor Cleveland Abbe will deliver four lectures on Climatology in its relations to Physiography. The lectures will given on January 6, 7, 8 and 9, 1896. The subjects are: 1. Sunshine and Temperature. 2. The Wind. 3. The Rain. 4. Snow and Ice.

THE Iceland Althing has requested the King of Denmark to communicate with other nations in regard to laying a cable from Iceland to the Continent. The resolution calls special attention to the importance of such a cable in the interests of meteorology.

ABOUT twelve of those who attended the Stirling County Ball on October 1st have since been seized with typhoid fever and three deaths have occurred. It is alleged that this resulted from eating contaminated oysters. At the opening meeting of the winter session of the Hull Scientific and Naturalists' Club, held on October 31st, Mr. Hollingworth, the President, delivered his presidential address on the artificial cultivation of edible molluscs. He said that in 1893 cholera broke out in 50 separate localities, attacking 287 persons, of whom 135 died; and out of these 50 localities, in 42 only single cases occurred, a circumstance hitherto unprecedented in the history of cholera, and pointing to special modes of infection. Of these cases 40 per cent. had eaten or handled shellfish within twenty-four hours of being attacked, and in most cases the shellfish had come from the Grimsby and Cleethorpes beds. Cholera had been imported into Grimsby from abroad, and the position of the oyster, mussel and cockle beds of Grimsby and Cleethorpes was such that they might have been infected.

DR. PHILIPP BERTKAU, assistant professor of zoölogy at the University of Bonn, died on October 22d.

MACMILLAN & Co. announce for early publication 'The Child in Primitive Culture and Folk-Thought,' by Dr. Alexander F. Chamberlain, of Clark University. The subject will be treated under the following subdivisions: Names of the Child; Child and Mother; Child and Father; The Child in the Primitive Laboratory; The Bright Side of Child-Life; Childhood the Golden Age; Children's Food; Children's Souls; Children's Flowers and Plants; Children's Birds and Beasts; Child-Life in General; The Child as Factor in Society; The Child as Linguist; The Child as Actor and Inventor; The Child as Musician and Poet; The Child as Wiseacre, Oracle, Judge; The Child as Hero and Adventurer; The Child as Fetish, Divinity, God; The Christ-Child; Proverbs and Sayings about Children and Childhood. An extensive bibliography is appended.

IT is stated in *Garden and Forest* that Dr. Chapman's herbarium of Southern plants, upon which is based his *Flora of the Southern States*, has been purchased by Mr. George W. Vanderbilt, and will serve as a nucleus of the scientific collections which he is establishing on his estate at Biltmore, in North Carolina, in connection with an arboretum and systematically managed forest.

UNIVERSITY AND EDUCATIONAL NEWS.

THE last Legislature appropriated a quarter of a million dollars to the Regents of

the University of California for the erection of a suitable building for the departments situated in San Francisco, the Colleges of Law, Medicine, Dentistry, Pharmacy and Veterinary Surgery. Adolph Sutro, Mayor of San Francisco, has given a tract of thirteen acres just south of and overlooking Golden Gate Park as a site for the building. On the adjoining thirteen acres Mr. Sutro proposes to erect a building for his magnificent library of about two hundred and fifty thousand volumes.

The work in Physics at the University of California, formerly done by the late Prof. Harold Whiting, who lost his life by the foundering of the Colima, is now divided between Dr. E. P. Lewis, formerly assistant in physics at the Johns Hopkins University and associate professor of physics in the Columbian University, and Dr. A. C. Alexander, formerly assistant in physics at the Sheffield Scientific School.

Mr. W. D. Frost, who has been assistant in the Laboratory of the Minnesota State Board of Health, has accepted a similar position in bacteriology in the University of Wisconsin.

During the summer an experimental laboratory in psychology has been fitted up at the University of Kansas. The work is in charge of Olin Templin, professor of philosophy.

The University of Pennsylvania has received additional contributions to the dormitory fund amounting to $40,000.

It is stated that Charles Broadway Rouss recently gave $25,000 to the New York Association of the alumni of the University of Virginia, for the fund to replace 60,000 volumes of the university library recently destroyed by fire.

Mr. Henry Lewis, A.R.S.M., has been appointed to the chair of mining in the Durham College of Science, which was recently vacated by Prof. Merivale.

Luman T. Jefts, of Hudson, Mass., has given $5,000 to Boston University to found a scholarship.

The attendance in the Scottish universities for the year 1894–95 was: Edinburgh, 2,924; Glasgow, 1,903; Aberdeen, 812.

Dr. Johannes Gad, professor of physiology in Berlin, has been called to the University of Prague, and Prof. Riedel, of Jena, has been called to the chair of surgery at Göttingen in succession to Professor König.

During the academic year 1894–95 the University of Leipzig granted the Ph. D. degree to 163 candidates.

The Bavarian government has appropriated $150,000 for the enlargement of the buildings of the University of Munich.

Prof. E. Mach, who has this year resigned a professorship of physics at Prague to accept the chair at Vienna vacated by the psychologist, Prof. Franz Brentano, gave an inaugural address on 'The Influence of Chance on the Development of Inventions and Discoveries.'

DISCUSSION AND CORRESPONDENCE.

THE INVERTED IMAGE ON THE RETINA.

To the Editor of Science—The discussion in recent numbers of Science concerning the inversion of the retinal image has occasioned me surprise, because I had supposed that the interpretation which has been familiar to me for many years had been universally accepted.

The interpretation is simply that we learn to associate the image with the correct position of the external object. Is it not the accepted view of psychologists that the primary conceptions of space are acquired by the child through touch and through its own movements connected with touch sensations? May we not look upon the visual sensations of external space relations as mental translations? If these two questions be answered affirmitatively, then seeing objects right side up, despite the inversion of their retinal images, is a purely psycho-

logical and not a sensory phenomenon, and Prof. Le Conte's ingenious explanation becomes unnecessary.

In parenthesis, may I not ask whether since the rods and cones are inverted, *i. e.*, turned away from the light, would not Prof. Le Conte's 'push' produce an inverted sensation?

That the rectification of the retinal image is a matter of experience, will, I think, be readily believed by any one who has worked much with the microscope. The microscope also inverts the image, and when it is re-inverted in the eye it falls on the retina rightly placed, that is to say without inversion. A beginner finds it almost impossible to move a preparation under the microscope in the way he wishes, but with practice the coördination of sight and movement becomes so perfect that the adjustment is unconscious. Now suppose a child had inverted glasses kept permanently before its eyes, so as to correct the retinal inversion, would it not learn to adjust all its movements, just as microscopists learn to adjust one set of movements? In short would not that child think it saw everything right side up? Would it be conscious of any peculiarity in its visual conditions—of a great difference between it and all other children? I think, clearly not.

CHARLES S. MINOT.

HARVARD MEDICAL SCHOOL,
November 11, 1895.

SHELLS AS IMPLEMENTS.

EDITOR OF SCIENCE: Since writing about the pierced mussel shells of Florida and from the Shingu I have received a most obliging letter from Dr. Karl von den Steinen, in which he says: "On the Shingu they scrape wood with the pierced mussel *Anodonta*, while the Bororó of the Southern Lorenzo use the pierced *Bulimus* in their woodwork. Oars, handles of axes and other implements, bull roarers and bows are rasped down and smoothed therewith. The objects are not put through the hole for polishing, but the mussel passes along them, the two edges of the hole operate alternately and greater accuracy of work and control over the implement are secured. The edge of the hole is not necessarily very sharp, neither does the workman retouch the edges as would the flint worker. He simply throws the shell away, or makes another hole, as do the Bororó when it fails to work.

"They make the hole with the point of a palm nut, *acuri* on the Shingu *oaussú* on the Southern Lorenzo. Before making the hole they remove the outer part of the shell with the teeth." Dr. von den Steinen also sends drawings of the Payaqua mounted spoon, with small, smooth holes bored near the hinge to aid in the lashing. I should like my colleagues to note this interesting information in connection with the mussel shells of the Southern United States, having holes punched through them.

O. T. MASON.

A REPLY.

EDITOR OF SCIENCE—I note the criticisms in SCIENCE for November 1st, which my friend, Mr. Witmer Stone, has made upon my little book, 'A Naturalist in Mexico,' and I beg leave to answer the same through the columns of the same paper.

In the first place I wish to say that a foot note was prepared for pages 13, 80, etc., but which unfortunately did not appear in the published edition, and which was printed as follows upon a slip to be inserted in the volume. This slip was not, unfortunately, placed in the first fifty copies, and hence Mr. Stone's very just first criticisms:

ERRATA: For the account of the early discovery and conquest of Yucatan, and for the measurements of the ruins of Uxmal and Labna, the author is indebted to Stevens' 'Incidents of Travel in Yucatan.'

For the data used in the descriptions of the mountains, and for the identifications, and some notes on the birds, and of the land and fresh-water shells, the author is indebted to the papers of Messrs. Heilprin, Pilsbry and Stone, published in the Proc. Phil. Acad. Sci., 1890–5.

Our next point is the description of the different measurements of Orizaba, which were taken from Prof. Heilprin's paper as a matter of course, since the original papers from which he took them were not at my command. The error of measurement by Dr. Kaska with a 'thermometer' instead of barometer is a typographical error.

In regard to his next point I fail to see how my short description of the birds could well be

made different, since we both collected them together, I shooting as many as did he, and our notes were of course the same, and as he was the official ornithologist I very naturally drew on him for the correct data, since my work was given to him for his paper. If Mr. Stone will look back he will remember that we saw a large number of small birds about Col. Glenns' camp which we both thought were finches and thrushes. We actually obtained very few specimens, hardly enough to say that birds were or were not abundant, and our short stay at each point (half a day to a week) hardly warranted us in drawing too fine conclusions. In regard to the Trogan, I have a note of another bird which I saw in the cactus thicket which I believe was a Trogan, although I will not be certain of the fact. It is quite natural that the note books of two naturalists should vary. I am certain that my bird, which was *not* shot, had a 'rose-colored breast.'

In regard to the rarified atmosphere observed on Mt. Orizaba, I still affirm that "my head swam and my eyes became bloodshot" and my companion, Mr. Stone, *complained* of the same symptoms, and also of pain in the stomach. This my note book shows. The figure of *Tyrannus vociferus* was inadvertently made to represent *T. tyrannus* by my brother, who made the greater number of the drawings. I do not find that I state anywhere that the figures were drawn especially for this work.

Lastly, let me state that the accusation of plagiarism made by Mr. Stone is quite unjust, as I trust I have shown in this communication. The paper referred to by him (notes on the Round-tailed Muskrat) was of but 2½ pages, and when information was used from Mr. Chapman's paper, he was given due credit.

Of the thirty odd papers which have appeared under my name this is the first that has caused me to be accused of plagiarism. It seems a very late date to call up a paper written seven years ago, when some of my more recent papers might answer the purpose fully as well. Finally, let me state that every statement made in my little booklet has been written from notes taken on the day each incident happened, and at *no* time has my imagination been brought into play, nor have I depended upon my memory. If Mr. Stone's notes vary from mine it is simply the very natural result of two persons taking notes independently. Mr. Stone's chief criticism seems to be the fact that his copy did not contain the reference slip of which I spoke. This I will send him. The real errors, of which there are many, will be corrected in a future edition.* FRANK C. BAKER.

CHICAGO ACADEMY OF SCIENCES.

SCIENCE AND CYCLOPÆDIAS.

TO THE EDITOR OF SCIENCE—*Sir:* Unpleasant as it is to criticise any book, I think I am justified in asking you to publish a few words concerning the new edition of Johnson's Cyclopædia. It appears to me that science is treated so insufficiently that attention should be called to it.

An article of about five pages *against* the scientific truth known as 'Evolution' is included in Vol. III. I think the Johnson Company cannot give the names of three men of recognized scientific position who could be induced to write in opposition to evolution. But no article appears *against* 'homœopathy,' although the entire scientific world has condemned it.

In the department of biography, the names of Platt and Croker may be found; but Eimer, (Weismann's great opponent) Mendeléeff, Ecker, Bütschli, Horsley (Victor), Nägeli, and a host of other eminent men who have contributed towards our knowledge of nature's laws, are omitted.

'Chemotaxis,' 'actinomycosis,' 'appendicitis,' 'metalloid,' and 'metagenesis' are not mentioned in this new cyclopædia. As the last two words have been used with more than one meaning, it is especially important that reference books should contain them.

'Panmixia' is explained in *eleven* lines in the article in favor of evolution by Mr. Kingsley.

I have been unable to find one word concerning that destructive little insect, 'orgyia lencosigma,' which must have interested many people for several summers past.

*I believe in exposing plagiarism wherever found, but do not see where that term can be applied to myself, in view of the facts which I have given. At the time my proof was read I was seriously ill with typhoid fever, and other parties corrected it.

The following evidence is offered with the object of showing by comparison that the space devoted to scientific subjects is utterly insufficient for the enlightenment of the general public.

'Degeneration' (two articles)—less than one and a-half cloumns.	'Pronunciation of foreign names' (exclusive of Latin and Greek names) over five columns.
'Parthenogenesis' one-half column, ending with 'the whole subject is obscure, however.' The reader is referred to Von Seibold, 'Parthenogenesis' and to Weismann, 'Essays on Heredity.' Both these works are far too technical to be intelligible to the general reader.	'Plattdeutsch' over four columns.
'Amphibia' one-half column.	'Pastoral Poetry' almost three columns.

Under 'Eclecticism' the reader is imformed that a certain Dr. Newton founded the theory of cellular pathology and introduced antisepticism in surgery. The scientific world has given the credit of the former discovery to Virchow, and of the latter to Lister. Now I ask, for purposes of information, what did Robert S. Newton (whose biography is not given in Johnson's Cyclopedia) write, or publish, upon cellular pathology, prior to the publication of Virchow's work in 1858? To credit anybody except Lister with the introduction of antisepticism is positively absurd.

'Monometallism' and 'bimetallism' are not to be found in this new cyclopædia under the proper headings; indeed, there are not even cross-references to 'money.'

The Johnson Cyclopædia is advertised by means of a sixteen-page circular, which bears neither publisher's nor author's name, a large part of it being devoted to abuse of what I have found a valuable, though by no means perfect, reference book, the *genuine* Encyclopædia Britannica. The writer of this sixteen page advertisement wishes his readers to believe that one half of the Britannica is of no use to Americans, if it is to anybody. I understand that Messrs. Appleton never place their name upon advertising circulars criticising the publications of other firms. I ask, in all fairness, is this honorable, or even reasonable?

I am not interested in any cyclopædia, nor in any publishing house, and this letter would not have been written had I seen any detailed, impartial criticism of the Johnson Cyclopædia.

LAWRENCE IRWELL.

BUFFALO, N. Y.

[Scientific subjects seem to be adequately treated in Johnson's Cyclopædia. The circular mentioned by our correspondent is, however, very objectionable, and the Johnson Co. should take steps to prevent its further circulation. J. McK. C.]

SCIENTIFIC LITERATURE.

An Atlas of the Fertilization and Karyokinesis of the Ovum. By EDMUND B. WILSON, PH. D., with the coöperation of Edward Leaming, M. D., F. R. P. S. New York, Published for the Columbia University Press, by Macmillan & Co. 4to with ten plates. Price $4.00.

This work is of a very high order, and both by its merit and its opportuneness is a noteworthy contribution to science. The basis of the work is Professor Wilson's able investigation of the early history of the ovum of one of our sea-urchins (*Toxopneustes variegatus*, Agassiz). The investigation was long and difficult, and its success is due in the first instance to the patient testing of many reagents until one was found which preserved the living organization of the ovum with a minimum of change. This reagent was a mixture of 80 parts of concentrated aqueous solution of corrosive sublimate and 20 parts glacial acetic acid. As the eggs are very minute, hundreds of them, all in the same stage, were imbedded at once, and sectioned together, leaving chance to determine that some of them be cut in favorable planes. The sections were made as thin as practicable, and were colored by Haidenhain's iron haematoxyline stain, also a reagent recently introduced. Of the many thousands, or perhaps hundreds of thousands of sections, the best have been sought out, and about two hundred of them photographed. From this collection of negatives, forty have been selected and reproduced as phototypes.

The photographs were all made by Dr. Edward Leaming, who in a prefatory note de-

scribes the photographic technique used. The pictures obtained represent the highest perfection of micro-photography yet reached, especially as applied to protoplasmatic structures. The reproductions are very good, but are not equal to the original negatives in delicacy and clearness.

The forty phototypes by themselves suffice to give a complete history of the maturation, fertilization and early segmentation of the ovum. Although they are less clear than many published drawings, these figures unquestionably take their place as the best we yet have, for their partial lack of distinctness is more than atoned for by their absolute accuracy and freedom from that element of personal interpretation which is unavoidable in every drawing, no matter how conscientiously made.

Each phototype is accompanied by a separate explanation of the details shown. This explanation, when necessary, is aided by diagrams inserted in the text.

To the whole is prefixed an abundantly illustrated '*General Introduction*,' in which Professor Wilson gives a summary of our present knowledge of the history of the ovum, so far as it has any bearing on the problems of fertilization. It would be very difficult to surpass this introduction, owing to its felicitous combination of terseness, clearness and completeness.

The work takes its place at once as a classic, and is certainly one of the most notable productions of pure science which have appeared in America. It will be valuable to every biologist, be he botanist or zoölogist, be he investigator or teacher. There will be many to congratulate the author upon his signal success.

Charles S. Minot.

A Monograph of the Order of Oligochæta. Frank Evers Beddard. Oxford, Clarendon Press. 1895. New York, Macmillan & Co. 4°, pp. xii+769. 5 plates, 52 wood cuts.

Mr. Beddard's Monograph of the Oligochæta has been awaited with no little interest by naturalists, and is the third comprehensive work dealing with the earthworms and their allies. The older work of Vejdovsky (1884) was largely morphological in character and confined chiefly to forms studied by the author, while the extensive work of Vaillant (1889–90) deals with the subject more from the systematic side, embracing descriptions of all known forms, but does not include references to literature published later than 1886. The present monograph is an attempt to bring together our knowledge of the entire subject up to the time of publication. It treats of both structure and systematic relationships and incorporates the large list of publications that have appeared during the last decade. No acconnt, however, is given of the embryology of the group, owing, the author tells us in his preface, 'to Prof. Vejdovsky's recently [1889–90] published Entwicklungsgeschichtliche untersuchungen, which go into the matter with all details.' The author recommends this work to 'those who are desirous of ascertaining what is known about the embryology of the Oligochæta.' It is to be regretted that Mr. Beddard did not include the embryology in his general plan and give us a complete treatise on the Oligochæta. Even an abstract of Vejdovsky's work would have added greatly to the value of the volume for the English reader.

The work is divided into two parts, the first (pp. 1–155) dealing with the anatomy and geographical distribution; the second, or systematic portion, comprising classification, phylogeny and descriptions of genera and species. The anatomical portion treats more of the grosser anatomy, comparatively little space being given to histological matters. We miss more particularly an account of the finer anatomy of the nervous system, the knowledge of which has been enriched by the recent researches of Von Lenhossèk and Retzius. The part devoted to the discussion of the nephridia is, to our mind, the most complete in the morphological portion of the work.

The author divides the Oligochæta into three groups; (1) Aphaneura, (2) Microdrili, (3) Megadrili. The Aphaneura correspond to Vejdovsky's group of the same name, while the Microdrili and Megadrili are equal in value to the old divisions Limicolæ and Terricolæ of Claparède, with the exception that the Aeolosomatidæ are separated from the Limicolæ and constitute the first group or Aphaneura. The names Microdrili and Magadrili thus have a broader application than Benham's use of them. Among

the Microdrili the Lumbriculidæ, Tubificidæ and Naidomorpha are united into the superfamily Lumbriculides; the Perichætidæ, Cryptodrilidæ and Acanthodrilidæ constitute the superfamily Megascolicidæ among the Megadrili. The three groups include about 125 genera and 650 species, divided between thirteen families. Vejdovsky's family of the Chætogastridæ is abandoned, the genus Chætogaster being placed in the Naidomorpha, and no mention is made of the doubtful family of Discodrilidæ of the same author, with its single representative, the leech-like parasitic Branchiobdella, while the Criodrilidæ of Vejdovsky are absorbed by the Geoscolicidæ.

It is to be deplored that numerous inaccuracies occur. Many of these, no doubt, are due to careless proof-reading, but some are of a graver sort, and of a kind to shake the readers confidence in the entire trustworthiness of the work. On page 110 we read that "there are as a rule but a single pair of glands [spermiducal glands] in the Megascolicidæ; but exceptions are known; thus with the exception of *Acanthrodrilus monocystis* the Acanthodrillidæ have always two pairs opening onto the seventeenth and eighteenth segments," but Fig. 45 shows that in five species of Acanthodrilus the spermiducal gland pores lie in segments XVII and XIX; further in the definition of the genus Diplocardia (also an Acanthodrilid) we read page 548 'spermiducal gland pores on XVIII, XX.' Again in the definition of the genus Diplocardia we see 'setæ paired, absent from segment XIX on which lie the male pores,' and turning to the definition of Diplocardia communis we find 'male pores on XVIII, XX.' This is worse than confusing. Occasional inaccuracies as to authorities also occur; for example on page 314, where the genus Distichopus is accredited to Verrill instead of to Leidy.

Great praise is due to the author for the exhaustive bibliography he has collected, however we feel compelled to censure him for the way in which it is put together, and we claim a certain right to do this since he tells us, at the beginning of his bibliography, that 'with a few exceptions (marked with an asterisk) every quotation has been verified by myself.' To begin with, we consider dates in bibliographical references to be of very great importance, but we find that only a very small percentage of the titles of the great list here given bear any date at all, and many of these are wrong. In addition to the omission of dates there are inaccurate details, the effect of which is to send one astray. One is not much aided by a reference without a date, to Vol. II., which should read Vol. XIX., as in Bergh (3); such references are unfortunately many. Again under Rosa (28) we are referred to 'ibid,' i. e., Ann. Mus. Civ. Genova, X., whereas the paper referred to appeared in Boll. Mus. Zool. Torino. II. T. Reichard appears for J. Reighard, and Lumbriculidæ for Lumbricidæ. Such slips are not confined to the bibliographical list; for example on page 711 we are referred to Rosa, Boll. Mus. Zool. Torino [no volume] 1872, when it should be twenty years later, in 1892. These examples are taken at random. There is no list of corrigenda. There is an index to genera and species only, and one is dependent upon a brief table of contents for other references. The imprint of the Clarendon Press is sufficient warrant for the typography and press work, which is of the highest order.

In conclusion, we would say that Mr. Beddard has undertaken a great task and has done it fairly well; he deserves the thanks of all students of the Oligochaets. A general synoptic key or table would have been a welcome addition for the student in the determination of species, while a careful revision of the manuscript would have made the book much more satisfactory. As it is, Mr. Beddard has given us an extremely valuable contribution to this branch of the Annelida.

W. McM. WOODWORTH.
FRANK SMITH.

A Manual of Qualitative Chemical Analysis, by E. P. HARRIS, PH. D., LL D., Professor of Chemistry in Amherst College. New Edition thoroughly Revised and Corrected. Amherst, Mass. 1895. 315 pages.

In most colleges the course in chemistry begins with lectures or recitations on the non-metals, generally combined with laboratory work, and this is followed by laboratory work in qualitative analysis. A question may be raised as to whether qualitative analysis is

the best medium through which to gain a knowledge of general chemistry either of the metals or the non-metals; indeed it is probable that the importance of qualitative analysis has been much over-estimated. It is of course necessary for those who intend to make a thorough study of the science, but the majority of college students do not pursue chemistry more than a single year, and it should not be difficult to devise a year's course in chemistry in which the student would gain far more knowledge of chemistry and more intellectual development than in the ordinary course, where such a large portion of the time is spent on qualitative analysis. There are dozens of laboratory manuals before us, in many, not to say most, of which the author's effort has apparently been to boil the matter down to the least possible space; the result has been the production of a series of more or less extended tables which the student follows blindly in searching for the contents of his unknown solutions, knowing nothing of the reasons for any step and gaining no knowledge of chemistry. Indeed, one may become a good analyst and know little of chemistry.

There are however teachers who use qualitative analysis as merely a medium of instruction in chemistry; who subordinate the acquisition of analytical skill to the acquisition of a knowledge of general chemistry and chemical theory. Such an one is the author of this book, and the present edition of his manual is the fruit of over three decades of laboratory teaching. The result is not a manual for self-instruction, but rather a guide to be used under the immediate supervision and instruction of a competent teacher.

The first half of the book is devoted to the reactions of the more common bases and acids, the students working with known solutions of a single salt and writing out each reaction on the blank pages with which this part of the book is interleaved. In this manner the student becomes familiar with these reactions, which represent all the ordinary ones used in qualitative and quantitative analysis. As he progresses in this work he is supposed to be furnished with solutions of unknown single salts for determination. This part is also intended to be supplemented by a course of lectures on the metals and their compounds. The second part of the book is devoted to the systematic examination of solids. The method used here is that which was first introduced by the author and is now with greater or lesser modifications generally in use. It is safe to say, however, that little improvement has been made upon the original.

This is followed by qualitative separations. Here, while alternate methods are now and then given, the methods are generally confined to that one in each case which has proved itself best in the author's experience. There is a decided advantage in thus limiting the possible modes of procedure, as freedom of choice is confusing to the novice. Indispensable as Fresenius is to the advanced student, it is almost useless to the inexperienced.

A supplement gives fully the reactions of nearly all the rare elements, while a chapter in the appendix on the preparation of reagents will be useful to teachers. The earlier editions of the book have proved its success in the hands of no inconsiderable number of teachers beside the author, and this revised edition, which is a very considerable improvement on those which have preceeded it, will be found even more valuable. If chemistry is to continue to be taught as largely through qualitative analysis as it has been in the past, this manual may safely be recommended as the best of its class. It is the writer's hope, however, that the day is not far distant when the improvement will be not along the old lines, but in the methods of chemical teaching themselves. The general style and make-up of the the book is good, but it is unfortunately marred by poor proof-reading.

Jas. Lewis Howe.

Washington and Lee University,
Lexington, Va., October 19, 1895.

La sensibilité de l'œil aux couleurs spectrales. M. H. Parinaud. *Revue Scientifique*, Sér. 4, T. 4, 134—141. August 3, 1895.

In the *Revue Scientifique* for June 8, Parinaud described an interesting series of experiments on the relative sensibility of the adapted and unadapted eye to spectral colors.* In the issue of the same journal for August 3 he gives his

*See review in Science, II., 418, Sept. 27, 1895.

physiological deductions. The experiments brought out three important facts, namely, (1) adaptation (20–30 minutes stay in darkness) affects the sensibility for colors unequally. Beginning at zero for the red, the improvement increases as the wave-length shortens till for the violet it is very considerable; (2) adaptation does not make the colors seem more intense as colors, but only more luminous, as if white light had been added; and this may reach such a pitch with very faint lights that the colors are wholly lost in the white light; (3) the sensibility of the *fovea* is unaffected by adaptation.

On these facts Parinaud bases a theory of the rods and cones and the visual purple. In the *fovea* there are cones only, and, as everywhere, they are without purple. Adaptation appears to be an affair of the rods and the purple; it takes place where they are found, and fails where they are absent. Since the luminosity alone is affected, it is natural to regard them as an end-organ for luminosity only, leaving the cones to mediate color. The matter is not so simple, however, as a mere separation of the organs, for the cones must also mediate white, and, indeed, in Parinaud's opinion, could do nothing more than that without the coöperation of the cerebral centers. Hemeralopia (night-blindness), which appears to be due to a deficiency in the purple, confirms this theory of its function, as also does the good development of the rods and purple in the eyes of nocturnal animals. The purple is able to increase the effect of faint lights because of a fluorescent or phosphorescent property. Parinaud's arguments for such a property make a very plausible case. If he is correct the purple becomes an agent for the actual production of light on faint luminous stimulation instead of an agent for increasing the irritability of the visual apparatus. The paper concludes with a fairly full account of the work of other observers in related lines.* The contribution is important in bringing together a number of more or less disregarded facts and showing their very great physiological significance.

E. C. SANFORD.

*The reviewer hastens to withdraw his criticism of the first part of M. Parinaud's paper for deficiency in this respect.

Geology of the Green Mountains in Massachusetts. By RAPHAEL PUMPELLY, J. E. WOLFF and T. NELSON DALE. Monograph XXIII of the United States Geological Survey. 1894. 4°. Pp. xiv, 206. Plates 23. Price $1.30.

The monograph before us is the most detailed and valuable contribution yet made to the solution of the much debated 'Taconic question,' than which none other has achieved greater prominence or excited more bitter feeling in the last fifty years of American geology.

Since the discovery of actual fossils in the metamorphosed strata of Vermont by the Rev. Augustus Wing, the labors of many have indicated the true relations that are now demonstrated, yet nevertheless the difficulties of the problem were so great, and the tendency to generalize without detailed field work had been so marked, that Mr. Pumpelly and his co-laborers decided to throw aside all previous conclusions and by detailed and patient observation, based upon topographic maps in a crucial area, to trace out step by step the relations of these much disturbed and metamorphosed sediments. Accordingly the northwest corner of Massachusetts was selected and study was focused especially upon Hoosac Mountain on the east, Greylock Mountain on the west and the valley between. Hoosac Mountain, well known for the famous tunnel that penetrates it, is an anticlinorium with a core of granitic pre-Cambrian gneiss (the Stamford gneiss), on which rests, with conformable lamination, another variable white gneiss that is at times a recognizable conglomerated and even a quartzite (the Vermont formation). Above the last and still conformable is a great thickness of albite schist (the Hoosac schist), which is itself succeeded on the east by the Rowe schist. The Vermont formation is Cambrian; the Hoosac schist is Cambrian below, Silurian above. The Rowe schist is Silurian and of minor importance in the problem. On the west side of Hoosac Mountain the Hoosac schist fails and the Vermont formation runs under the Cambro-Silurian Stockbridge limestone that has been degraded to form the valley. It should be remarked that all the strata of Hoosac Mountain proper, except the Stamford gneiss, are metamorphosed *clastics*.

Greylock Mountain, with its spurs, is a

double synclinorium, whose lowest member is the Cambro-Silurian Stockbridge limestone. This is succeeded by the Berkshire schist, the Bellowspipe limestone and the Greylock schist, all Silurian. Now, the interesting geological thesis established by the monograph is that the metamorphosed clastics of the Hoosac Mountain are the shore deposits, which in the case of the Hoosac schist correspond to the deeper water, Stockbridge and Bellowspipe limestones and their accompanying schists. The determination throws a flood of light on the entire stratigraphy of the region, and simplifies the problem of the Green Mountains. The difficulties that were overcome in tracing out these metamorphic schists to their original sediments, in proving the uncomformability of the Vermont conglomerate gneiss upon the Stamford gneiss, when the foliation was the same in both, and the neat way in which it was done by the discovery of the eroded and depressed pre-Cambrian outcrop of a trap dike in the Stamford gneiss, which was buried under the Vermont formation, all called for patient study and close observation in the highest degree. And when the passage of the Hoosac schists into the Stockbridge limestone was finally established, a very hard problem was at last solved. The authors are to be warmly complimented and congratulated on their success.

Besides the stratigraphic results, many important contributions are made to our knowledge of the general metamorphism of sediments to crystalline schists.

The three authors were also aided in a degree calling for mention by Mr. B. T. Putnam, whose untimely death removed him in the midst of his career, and by Prof. W. H. Hobbs. The report is richly illustrated with that profusion of maps and plates which is only attainable in this country by attachés of the United States Survey. The investigations have been continued on the south by Professor Dale, whose later results are published in the Fourteenth Annual Report of the Director as reviewed in these columns, p. 632.

J. F. KEMP.

The Laccolitic Mountain groups of Colorado, Utah and Arizona. WHITMAN CROSS. 14th Annual Report of the Director of the U. S. Geological Survey, Washington, 1894. Pp. 165–241. Pt. ii.

Mr. Cross makes in this paper the second considerable contribution to our knowledge of laccolites, the first having been made by Gilbert in 1877. The West Elk Mountains, in Colorado, including Ragged Mount, Mt. Marcellina, the Anthracite range, Mt. Axtell, Mt. Carbon, Mt. Wheatstone, Crested Butte, Gothic Mount and probably others in the same group, are laccolitic in origin. So also are the San Miguel Mountains, about 70 southwest of the West Elk group. Still farther south, at a distance of 25 miles, the La Plata Mountains form a remarkable group of laccolites. About 65 miles farther south-west, in the northeastern corner of Arizona, lie the Carriso Mountains, the laccolitic nature of which is not positively stated. El Late Mountains, in the southwestern corner of Colorado, are believed to be laccolites. Next, the Abajo Mountains of eastern Utah are compared with the laccolites of the type area, and the La Sal Mountains, about 35 miles north of the Abajo Mountains, are only doubtfully considered as due to intrusions. In discussing the conditions of intrusion in laccolites, Mr. Cross concludes in agreement with Dana that Gilbert's explanation of the incoming of the magma into the strata is complete without reference to the relations which may exist between the densities of the lava and the stratified rocks.

Comment: The time of formation of laccolites and volcanoes in the same field seems not yet to be fully determined, but in two of the areas described it is probable that laccolites were first formed and subsequently dikes and volcanic rocks were formed, the former appearing at the present denuded surface and the latter having poured out upon the surface. If this order should prove generally true, it would agree with that observed in the case of small intrusions in the Boston basin. Thus in the slate area bordering the Mystic River there are at least three series of intrusions in the form of dikes and sills. The sills, here the analogues of laccolites, are in every instance connected with the earliest movements of the magma. Moreover, the sills came in before the

strata were well jointed, and at a time when the stratification planes were the leading lines of weakness. The dikes connected with the sills have irregular contact planes. The later dikes which cut the sills follow master joints. There is reason, in this field at least, for supposing that intrusion in the form of sheets took place, because the rock yielded more readily in a horizontal direction along the bedding planes than it did along vertical lines. But there is little in the mode of occurrence, or in the scale of these intrusions or the elevation of the strata above them, to afford a full comparison with the typical laccolites of the West.

In the review of the literature of laccolitic intrusions, an early account of a quaquaversal hill covering a domeshaped mass of trap in Derbyshire, England, seems to have been overlooked. The account and a cross-section will be found in Bakewell's Introduction to Geology, 2d Am. ed., New Haven, 1833, pp. 95–97.

J. B. WOODWORTH.

HARVARD UNIVERSITY.

Bibliography of North American Paleontology 1888–1892. By CHARLES ROLLIN KEYES. Bull. U. S. G. S., No. 121. 251 pp. Washington. 1894.

This publication will be received with welcome by paleontologists. Each separate paper appears under several subject headings, biologic, stratigraphic or geographic, so that the cross references make the list as good a substitute for a card catalogue as a printed list can be.

Several criticisms can, however, be made, for a close examination shows the work to be full of imperfections. Firstly, the compilation was carelessly done. This is evidenced in the careless copying of titles as well as in the omission from the list of nearly 150 papers published during 1888–1892, which is one sixth of the total number of papers appearing in the list under the authors' names. In many cases the titles are not given in full (as it is claimed they are in the introduction, p. 7).

Examples of such wrong copying are:

P. 229, second entry should be—Vodges, A. W. A Bibliography of Paleozoic Crustacea from 1698 to 1889, including a list of North American species and a systematic arrangement of genera.

P. 70, seventh entry includes two separate papers by separate authors. They are—Dawson, J. William. Preliminary note on new species of sponges from the Quebec Group at Little Mètis (Can. Rec. Sci. III, 49–59, figs. April, 1888). Hinde, George Jennings. Notes on sponges from the Quebec Group at Mètis, and from the Utica Shale (Can. Rec. Sci. iii, 59–68. April, 1888).

P. 183, second entry should be—Ringueberg, Eugene N. S. The Crinoidea of the Lower Niagara Limestone at Lockport, N. Y., with new species.

P. 190, third entry should be—Shaler, N. S. The Geology of the Cambrian District of Bristol county, Mass.

P. 108—Hollick, Alfred, should be—Hollick, Arthur.

P. 73, fourth entry should be—Hamilton, Chenango and Otsego counties, New York.

P. 73, third entry. 'Geology of Skunnemunk Mountain, Osage county, N. Y.,' should be ; Geology of Skunnemunk Mountain, Orange county, N. Y. This title together and several others, though appearing under certain of the subject headings, are not entered under their author's names.

Pp. 21, 86, 198, 226. — 'Bison latiformis' should be Bison latifrons.

Pp. 30, 39, 42, 71.—The generic term Clymenia (a Cephalopod) appears as 'Calymene' (a Trilobite).

The proof reading is very bad, surprisingly so in a publication issued by the United States Geological Survey. The proof was read evidently by a person having no knowledge whatever of paleontological terms, for a large number of generic and specific names are incorrectly spelled. Some of the most unpardonable mistakes are 'Necomian,' 'Cheyene,' 'Ciasaurus,' 'Paneka,' 'Ceatopsidæ,' 'Foraminiferial,' etc.

P. 76, twelfth entry, 'Magia' probably means Niagara. The spelling in the species lists under titles of Matthew, G. F., is particularly bad.

The value of the publication would be greatly increased were the subject-matter printed on one side of each sheet only. This arrangement would enable the working paleontologist to

cut out the various items for pasting upon cards of his catalogue.

Appended are some of the more important papers which, though having appeared during the interim of 1888–1892, have not been listed by Mr. Keyes.

Ami, Henry M. Notes and Descriptions of some New and hitherto Unrecorded Species of Fossils from the Cambro-Silurian (Ordovician) Rocks of the Province of Ontario. Can. Rec. Sci. v, 96–103. April, 1892.

Ami, Henry M. Palæontological Notes I. On a Collection of Fossils from the Ordovician of Joliette in the Province of Ontario. Can. Rec. Sci. v, 104–107. April, 1892.

Ami, Henry M. Palæontological Notes II. On the Occurrence of Fossil Remains on the Manitou Islands, Lake Nipissing, Ontario. Can. Rec. Sci. v, 107–108. April, 1892.

Ami, Henry M. The Utica Terrane in Canada. Can. Rec. Sci. v, 166–183; 234–246. July and October, 1892.

Beecher, Charles E. On the Development of the Shell in the genus Tornoceras, Hyatt. Am. Jour. Sci. xl, 71–75, i. July, 1890.

Calvin, S. Some New Species of Paleozoic Fossils. Bull. Lab. Nat. Hist. State Univ. Iowa, i, 173–181, i–iii. June, 1890.

Dawson, J. Wm. On Sporocarps discovered by Prof. E. Orton in the Erian Shale of Columbus, Ohio. Can. Rec. Sci. iii, 137–140. July, 1888.

Hollick, Arthur. Additions to the Paleobotany of the Cretaceous Formation on Staten Island. Trans. N. Y. Ac. Sci. xii, 28–39, i–iv. Nov., 1892.

Hollick, Arthur. Paleobotany of the Yellow Gravel at Bridgeton, N. J. Bull. Torr. Bot. Club, xix, 330–333. Nov., 1892.

Hyatt, Alpheus. Jura and Trias at Taylorville, Cal. Bull. Geol. Soc. Amer. iii, 395–412.

Koken, E. Ueber die Entwickelungsgeschichte der Gastropoden vom Cambrium bis zur Trias. Neues Jahrb. Min., etc., B. B. vi, 305–484, x–xiv. 1889.

Lapworth, Chas. On Graptolites from Dease River, B. C. Can. Rec. Sci. iii, 141–142. 1888.

Matthew, G. F. Illustrations of the Fauna of the St. John Group. No. vii. Trans. Roy. Soc. Can. x, Sect. iv, 95–109, pl. i. 1892.

Matthew, G. F. On the Diffusion and Sequence of the Cambrian Faunas. Trans. Roy. Soc. Can. x, Sect. iv, 3–16.

Scudder, Samuel H. Illustrations of the Carboniferous Arachnida of North America, of the orders Anthracomarti and Pedipalpi. Mem. Bos. Soc. Nat. Hist. iv, 443–456, xxxix–xl. 1890.

Scudder, Samuel H. The Insects of the Triassic Beds at Fairplay, Colo. Mem. Bos. Soc. Nat. Hist. iv, 457–472, xli–xlii. 1890.

Ulrich, E. O. Notes on Lower Silurian Bryozoa. Jour. Cin. Soc. Nat. Hist. Jan., 1890. Pp. 173–198.

Whitfield, R. P. Contributions to Invertebrate Paleontology. I. Descriptions of Fossils from the Palæozoic Rocks of Ohio. Ann. N. Y. Ac. Sci. v, 505–622, v–xvi. 1891.

Williams, Henry S. An account of the Progress in North American Paleontology for the years 1887, 1888. Smithsonian Report for 1888. Pp. 261–326. 1890.

Gilbert van Ingen.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON, 248TH MEETING, SATURDAY, NOV. 2.

Mr. F. V. Coville spoke of the botanical explorations of Thomas Coulter in Mexico and California.

Thomas Coulter, the Irish botanist, he said was born in the year 1793, near Dundalk, Ireland. He received his A. B. degree at Dublin University in 1817, and his A. M. in 1820. He then went to Geneva, where he studied for about three years under DeCandolle, and published a monograph of the Dipsaceæ in 1823. In 1824 he sailed for Mexico, where for six years he made collections of plants at Real del Monte, Zimapan, Zacatecas, Hermosillo and presumably at intermediate points. In 1831 he reached Monterey, California, where he spent the winter with David Douglas, the Scotch botanist, and in the following Spring he made a journey from Monterey by way of San Luis Obispo, Santa Ynez, Santa Barbara, San Buenaventura, San Fernando, San Gabriel, Pala and San Felipe to a point on the Colorado River eight miles below its junction with the Gila, returning by

the same route. After making collections in other directions from Monterey, he returned to Europe by way of Mexico, reaching London in November, 1834, and bringing with him a collection of about fifty thousand herbarium specimens, besides a thousand woods and a complete journal of his travels and experiences. He presented his collections to Trinity College, Dublin, and thus became the founder and keeper of that well known herbarium. His journal was lost in transport between London and Dublin, and this together with his continued ill health kept him from publishing an account of his travels and work, which was thus left incomplete at the time of his death, in 1843. The duplicates of his collections were subsequently distributed in part by his successor, W. H. Harvey, at least two of the sets reaching America, one presented to Dr. Gray, the other to Dr. Torrey. Though no general report on his collections was ever published, a large number of species have been described from them, more than forty receiving the specific name *coulteri*. The information on which this outline was based was drawn principally from scanty published records together with a series of letters from Coulter to A. P. and Alphonse DeCandolle, which were exhibited at the meeting by Mr. Coville through the courtesy of Dr. Casimir DeCandolle, of Geneva.

Mr. William Palmer exhibited some specimens of birds having albinistic feet, saying that albinism of the beak and feet was rare, and that he had never seen an example of the former except in complete albinos. Partial albinism he thought to be due to temporary causes, such as defective nutrition, and he instanced cases in which white feathers had, upon moulting, been replaced by those normally colored.

Mr. F. A. Lucas spoke on the gigantic extinct birds of Patagonia, briefly reviewing Señor Ameghino's recent memoir on the subject. He considered that these birds belonged to an extinct avifauna, represented by a few forms like Palamedea and Psophia, and that many forms were needed to fill in the gap between them and existing birds. It was useless, he thought, to make any comparisons with struthious birds and he deprecated the use of the divisions *Ratitæ* and *Carinatæ* as being unnatural.

Dr. Theo. Gill spoke *On the Belone and Sarginos of Aristotle*, and the misuse of zoölogical names of the ancients by writers like Linnæus, dwelling at length on the Belone and Sarginos. The Belone, as is quite evident from the several passages wherein the name occurs, was the small pipe-fish, or Syngnathid, and its misapplication to the gar-fish was entirely unjustifiable. The gar-fish, however, was undoubtedly familiar to the ancients and the old Greek name can be discovered by a comparison of the name of unidentified species enumerated by Aristotle and those now current in Greece and the Archipelago. One of the hitherto unidentified Aristotelian names is *Sarginos*, and at the present time that name under a slightly different form still prevails and is applied to the gar-fish. The modern variants are *Zargana* and *Sargannos*. The application of Belone to the gar-fishes was unfortunate, but happily the name must be given up and Esox used in its place. Esox itself, however, is another example of misuse of ancient names, for the *Esox* mentioned by Pliny was apparently a sturgeon. The misuse of *Trochilus* and *Amia* was also dwelt upon.

Dr. Erwin F. Smith exhibited some plants showing the effect of inoculation with the organism of cucumber blight.

F. A. LUCAS, *Secretary*.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

THE 111th regular meeting was held November 7, 1895.

Mr. Hubbard read a paper entitled 'Some Insects which brave the dangers of the Pitcher Plant,' giving observations supplementary to those recorded 20 years ago by Riley, on the insects found in connection with *Sarracenia variolaris*. Mr. Hubbard's observations were made upon *S. flava*, a species common in Georgia and Florida. Mr. Hubbard found the larvæ of the two species of Xanthoptera described by Riley living unharmed in these pitchers. He found that an enormous number of insects were captured by the pitchers, among others the honey bee, species of Bombus and Megachile, sand wasps and many other insects. He found that a Sphegid makes its nesting place within the pitchers and that a species of Lycosa habitually spreads its web within them.

Sarcophaga sarraceniæ is so uniformly present and so abundant in every species of pitcher plant known to the speaker that he is constrained to think that the species has a more intimate connection with the economy of the plant than has been assigned to it.

Mr. Howard read a lengthy paper entitled 'Notes on the Life-history of *Culex pungens*, with remarks about other Mosquitoes.' He gave results of actual rearing of *C. pungens* in Washington, showing that a generation may develop in ten days. Other mosquitoes occurring at Washington are *Psorophora ciliata* and *Anopheles quadrimaculatus*. The subject of mosquito remedies was treated in extenso. The paper was discussed by Messrs. Gill, Marlatt, Ashmead, Hubbard, Mann and Benton.

Mr. Heidemann exhibited specimens of the winged form of *Rheumatobates rileyi* and *R. tenuipes*. These specimens were of especial interest since Meinert doubts the existence of winged individuals.

Mr. Ashmead exhibited certain Mutillidæ and called particular attention to the differences between Sphærophthalma and Photopsis, expressing himself as of the opinion that one section of the genus Photopsis is based entirely on males of Cyphotes.

Mr. Hubbard exhibited a brood cell of what is probably *Xyleborus pini*, announcing the discovery that this insect in its brood cell constructs a cemetery for dead larvæ and adults, removing them entirely from the main portion of the cell in which grows the ambrosia upon which the larvæ feed. He compared the intelligence exhibited in this way with that shown by ants, since certain of the latter insects cultivate fungi and similarly set aside spots to be used for cemeteries.

L. O. Howard, *Recording Secretary.*

New York Academy of Sciences.

The Academy met on October 28, with Vice-President Stevenson in the chair. After the usual routine business the Geological Section organized and listened to the following paper:

Geological notes from Long Island and Nantucket by Arthur Hollick. The author described the further discovery of fossil Cretaceous plants at Center Island in Oyster Bay, along the north shore, and on Montauk Point, the northeastern extremity. He also mentioned the finding of several boulders containing marine Cretaceous molluscs, and set forth the reasons for thinking that the New Jersey greensands had formerly existed in the basin of Long Island Sound. Recent observations and lists of fossils from Sankaty Head, Nantucket, concluded the paper. Among these was a fragment of silicified Palm-wood, the first specimen of the kind recorded from eastern North America. Discussion followed by W. M. Davis.

The second paper was by Gilbert Van Ingen and T. G. White: "An account of geological work the past summer on Lake Champlain." The paper described the results of recent stratigraphical studies on the Trenton limestones and briefly outlined the character and relations of the faunas. An abstract will appear in the Transactions of the Academy of even date.

After routine business on November 4 the Section of Astronomy and Physics organized, and listened to a paper, by Prof. R. S. Woodward, upon 'Systems of Mechanical Units.' Mr. Woodward referred to the importance of the dimensional formulæ in discussing systems of units, and called attention to their introduction in 1821 by Fourier, and their subsequent revival by Maxwell. He pointed out some of the difficulties arising from the adoption of the present fundamental units of length, mass and time, and showed how, by the elimination of either length or time and the substitution of energy, new systems could be obtained. He dwelt upon the desirability of the system in which energy replaces time for those people who may have no conception of time, and pointed out that the conceptions of energy are certainly as distinct as those of mass and possibly even as distinct as those of length and time. This paper was discussed by Profs. Pupin, Hallock and Pfister.

Prof. Harold Jacoby then read a paper received too late for announcement in the Bulletin, on 'Suggestions as to the determination of the relative mass of the two components of the double Star Eta Cassiopeiæ,' from Rutherfurd photographic measures. Prof. Jacoby outlined the method to be pursued in this investigation, and deduced the formulæ to be used. The

calculations will be made by Mr. Davis. The paper was discussed by Prof. Rees.

Prof. Pupin then explained a method of measuring alternating currents with a galvanometer. It consists in placing in the circuit a primary cell and an electrolite cell whose counter electro-motor is slightly greater than that of the primary cell. Under these conditions only one-half of the alternations passed through the circuit, the other half being stopped by the two cells. Experiments have shown the availability of this method up to 600 alternations per minute.

J. F. KEMP, *Secretary.*

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, OCTOBER 22, 1895.

The Development of Oligoporus. By ROBERT T. JACKSON.

The following is an abstract of the results of recent studies of the Palæoechinoidea. In Oligoporus the interambulacra terminate ventrally in two plates, which present on their oral faces a reëntrant angle for the reception of a single initial plate of the area. Proceeding dorsally, new plates and new columns of plates are added, accenting by their appearance stages in growth, as he had previously shown in Melonites, until the full complement of the species is attained. The single initial interambulacral plate of Oligoporus was compared with a similar plate in Melonites, Lepidechinus, young modern Cidaris, etc. At the ventral or younger portion of the corona of Oligoporus there are only two columns of ambulacral plates. The four columns characteristic of the adult are derived from these two by a drawing-out process. The four columns of ambulacral plates of adult Oligoporus are the equivalent of the two outer and two median columns of Melonites. These four columns in both genera are the morphological equivalent of the two columns seen in the ambulacra of Bothriocidaris, Cidaris, etc.

Oligoporus, as shown by the development of both ambulacral and interambulacral areas, is a genus intermediate between Palæechinus and Melonites. During the development of Oligoporus it passes through a Rhœchinus stage, and later a Palæechinus stage. Melonites in its development passes through an Oligoporus stage.

An early stage in developing Echinoderms was named the 'protechinus' stage. At this stage are first acquired those features which characterize the developing animal as a member of the Echinoidea. The protechinus stage in Echinoderms is directly comparable to the protoconch of Cephalous Mollusca, the protegulum of Brachiopods, the protaspis of Trilobites, etc. The Echinoderm at this period in its growth has a single interambulacral plate (representing a single column of such plates), and two columns of ambulacral plates in each of the five areas. This stage is seen in Oligoporus, Lepidechinus, Goniocidaris and other genera; it finds its representative in an adult ancestral form, in the primitive, oldest known genus of the class, Bothriocidaris, of the Lower Silurian, which has but one column of interambulacral and two columns of ambulacral plates in each area.

Species of Oligoporus and Melonites with few interambulacral columns are considered the more primitive types, as they are represented by stages in the development of those species which acquire a higher number of columns in the adult.

The structure of the ventral border of the corona of Archæocidaris was described. It presents a row of plates partially resorbed by the encroachment of the peristome, as in modern Cidaris, etc. Ambulacral and interambulacral plates on the peristome were described in Archæocidaris, also teeth and secondary spines on the interambulacral plates of the corona.

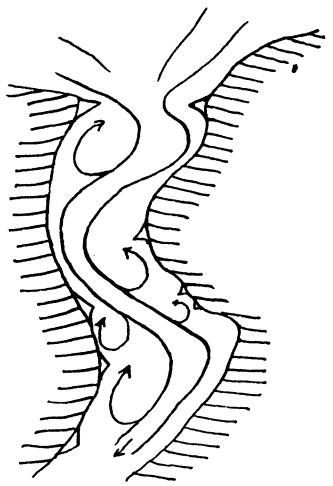
This paper contains a classification of Palæozoic Echini based on the structure and development of the ambulacral and interambulacral areas and the peristome. It will be published in the Bulletin of the Geological Society of America.

Tidal Sand-cusps. F. P. GULLIVER.

In the rias, or drowned valleys, of the Puget sound region, Washington, occur many cuspate deposits of sand projecting from the valley sides into the tidal inlets. West point, north of Seattle, is the typical example (Coast Survey, 653; Geological Survey, Seattle sheet). These points always project at right angles both to the shoreline and to the general direction of in and out flowing tidal currents. They vary in stage

of development from an early condition of a V-shaped bar inclosing a lagoon, similar to the bars described by Mr. Gilbert on the Bonneville shoreline (Mon. I., U. S. G. S. 1890, 58), to the stage where the lagoon has been filled and the marsh covered with sand dunes. These sand cusps were not produced by ocean eddy currents as in the case of Hatteras, Lookout, etc. (C. Abbe Jr., B. Soc. Nat. Hist., XXVI., 1895, 489–497). Along the outer shoreline the ocean currents with large radii of curvature are effective, but upon the inner shore line the tidal currents are the more important agents. The terms inner and outer are adapted from those used by Prof. Penck in Morphologie der Erdoberflache, 1894, II., 551.

An ideal scheme of inflowing tide with its eddies is given in the figure. The outflowing tide



would reverse the direction of flow and transportation of shore drift.

Other examples of similar cusps whose formation has been referred to tidal action are those on Coatue beach, Nantucket (N. S. Shaler, Bull. U. S. G. S., No. 53, 1889, 13), and Romney marsh in southeast England (W. Topley, Geol. of the Weald, 1875, 211, 303). This material was presented as a portion of a thesis to be published at a later time.

MEETING OF OCTOBER 29, 1895.

Some Features of the Arizona Plateau. L. S. Griswold. Illustrated by stereopticon.

The district here considered includes parts of northeastern Arizona; the middle portion of the valley of the Little Colorado, the region about the San Francisco Mountains, and a portion of the Grand Cañon of the Colorado, being the localities best observed.

In general the plateau surface is between 5,000 and 7,000 feet in elevation above sea level and strikes one as being remarkably smooth for so high elevation; there are large stretches of nearly level or gently rolling country, diversified, however, by mesas and outliers with escarpments rising between 50 and 200 feet, shallow but broad old stream channels now little used and leading to cañons with precipitous walls. On the plateau top are numerous volcanic elevations, varying in age from the young cinder cone to the denuded stock. Over the district silicified wood is well known, occurring at the base of a gravel and sand horizon, little consolidated, belonging to late Tertiary or Pleistocene times, and lying with slight unconformity in part upon probable Triassic strata and in part upon Carboniferous, the older formations being little disturbed.

The trees now petrified, originally grew to large size, eight or nine feet in diameter for the largest, probably conifers, and perhaps not very different from the forest growth of part of the present plateau. This ancient forest was apparently thrown down by the wind, for tree butts are common in horizontal position, while only one was found erect. The gravel and sand covering would seem to have come soon, for only a few have fillings of sediment in hollows or give other indication of decay; the logs were buried at least fifty or sixty feet deep. The weight of the overlying sediments crushed the trees so that the horizontal diameters are commonly greater than the vertical as they are seen in place. Silicification was probably accomplished by percolating surface waters, as the logs are distant from volcanic vents, as far as known to the writer; then no hot water deposits were seen accompanying the logs, and the distribution as seen over many miles and reported much more widely would also militate against the theory of change by hot waters.

The stages noted in the development of the plateau would begin with a baseleveling of the

older formations, Carboniferous-Triassic; in late Tertiary or early Pleistocene times a forest growth was apparently thrown down and soon covered by coarse sediments, after which percolating waters replaced the vegetable matter with silica. The existence of the widespread gravels necessitates belief in an equally widespread plain in late Tertiary or Pleistocene times. An uprising of perhaps a few hundred feet gave opportunity for wearing away the gravels and the upper part of the older formations, and the valley systems broadened and interlocked to produce mesas and outliers, while streams gained a meandering habit to some extent. A second and great uplifting to the present plateau altitude gave opportunity for the greater drainage lines to cut deep trenches with precipitous sides. The subordinate drainage in the Carboniferous limestone region seems to reach the cañon bottoms chiefly by underground channels, the old surface valleys showing small traces of recent work, while on the other hand the development of sink holes has begun. In the sandstone and shale regions the water in part goes underground to the main channels; in part it is carving the plateau surface by a system of 'box cañons.'

The volcanic work would appear to have begun after denudation of the Tertiary or Pleistocene plain had progressed far, but before the second or cañon elevation; the large number of volcanic masses in all stages of destruction evinces a pretty continuous activity until perhaps the last few centuries.

THE ACADEMY OF SCIENCE OF ST. LOUIS, MO., NOVEMBER 4, 1895.

THE Academy held its regular meeting with President Green in the chair and thirty-three members and visitors present.

Prof. Francis E. Nipher, as a committee appointed by President Green, read a memorial of the late Prof. C. V. Riley, dwelling briefly upon Prof. Riley's life and work, and especially his great achievements in the field of economic Entomology.

Prof. H. S. Pritchett presented a communication on 'The Resumé of Certain Studies of the Satellite System of Saturn,' calling attention to the remarkable similarity between this system and the solar system, and also the frequent eclipses to which the satellites of Saturn are subjected.

A very interesting exposition was given of the effect of the attraction of the large satellite Titan upon the smaller Hyperion, resulting in great eccentricity of the orbit of Hyperion and a rapid revolution of its pericentric. Mention was also made of the curious phenomena of the satellite Iapetus being much brighter on one side than on the other, and of its revolution on its axis coinciding with its revolution around the planet.

The paper was followed by a discussion as to the nature of the Saturnian system of rings and satellites.

Prof. Nipher presented a paper on 'The Law of Minimum Deviation of Light by a Prism.'

Adjourned.

A. W. DOUGLAS,
Recording Secretary.

SCIENTIFIC JOURNALS.

JOURNAL OF GEOLOGY, OCTOBER–NOVEMBER.

On the Cliffs and Exotic Blocks of North Switzerland: By E. C. QUEREAU. Certain exotic rock masses occurring along the north border of the Alps and Carpathian mountains have long been more or less a puzzle to geologists. They occur on the Flysch, which is Eocene, while the fossils found in the cliffs have been pronounced by Professors Kaufmann, Steinmann and the author to be Jurassic. Two explanations have been offered for the phenomenon: First, that the cliffs were forced up through the newer rocks. Second, that they were thrust over them. Of these hypotheses the author maintains the latter. He finds the source to the north in a mountain system 'das Vindelisische Gebirge," now buried under the Miocene of the Swiss plain, the existence of which was predicated on entirely different grounds by Professor Studer and other Swiss geologists.

The Preglacial Valleys of the Mississippi and its Tributaries: By FRANK LEVERETT. That drainage systems were greatly changed by the advance of the ice is no longer doubted. The author has in this paper gathered a large amount of data with reference to preglacial

drainage lines in the north part of the Mississippi basin, in the hope that such facts may lead to inferences concerning the preglacial altitude of the region, differential crust movements, the effect of glaciation in enlarging and deepening valleys and other questions relating to glacial influence.

The Classification of the Upper Paleozoic Rocks of Central Kansas: By CHAS. S. PROSSER. This is the concluding portion of the paper begun in the last number of the *Journal*. It gives a detailed study of the paleozoic series from the Waubansee beds of the author in the U. Coal Measures to the Marion beds in the Permian. The paper is a valuable contribution to the stratigraphy of Kansas and its value is enhanced by the table of formations accompanying.

The Volcanics of the Michigamme District of Michigan: By J. MORGAN CLEMENTS. These rocks are Huronian in age and lie to the west of the Archean core between Bone Lake on the north and Crystal Falls on the south. They have a thickness of about 4,000 feet and vary in character from melaphyre and porphyrite to quartz-porphyry and devitrified rhyolites called aporhyolites. As a result of his study of this series, the author confirms the conclusions of many late investigators regarding the identity of these older volcanics with modern lavas and proposes to name them accordingly..

The Influence of Debris on the Flow of Glaciers: By ISRAEL C. RUSSELL. The principle maintained is that the flow of a glacier under given conditions will depend on the percentage of debris mingled with it and will be least when that percentage is greatest. This principle is applied in explaining the irregularities of glacial erosion and deposition, such as subglacial gravel deposits, the formation of complex terminal moraines and the difficult subject, the origin of drumlins. He sees no good reason why we may not have drumlins of sand, loess or gravel, as well as till.

Glacial Studies in Greenland No. VIII: By T. C. CHAMBERLIN. This is mainly a description of the krakokta glacier which descends northerly from the Redcliff peninsula. The relations of this glacier to its moraine are followed with some detail. Where it meets the Tuktoo glacier moving southward, a joint moraine is produced, which perhaps is medial in position, but terminal in nature. At some places the ice lies well within its moraine, and at others the moraine is completely overridden by recent advances of the ice. The photographs illustrate these points as well as the regular and beautiful stratification of the glacier and its freedom from debris, except in the lower portion.

The Editorial: By R. D. SALISBURY gives a condensed account of the Peary Relief Expedition of the present summer, and of the results, geological and otherwise, of Mr. Peary's work during two seasons in Greenland.

Reviews are contributed by J. P. Iddings, T. W. Stanton, S. Weller and T. C. Hopkins.

NEW BOOKS.

Die Artbidung und Verwandtschaft bei bei den Schmetterlingen (Part 2). DR. G. H. THEODOR EIMER. Jena, Gustav Fischer. 1895. Pp. 153.

A Handbook of British Lepidoptera. EDWARD MEYRICK. London and New York, Macmillan & Co. Pp. vi.+843. $325.

Notes on the Nebular Theory. WILLIAM FORD STANLEY, London, Kegan Paul, Trench, Trübner & Co., Ltd. 1895. Pp. xv.+259.

Problems in Differential Calculus. W. E. BYERLY. Boston and London, Ginn & Co. 1895. Pp. vii+71.

The Production of Iron Ores in Various Parts of the World. JOHN BIRKENBINE. Washington. 1895. Pp. 204.

A Handbook of Industrial Organic Chemistry. SAMUEL P. SADTLER. Second Edition. Philadelphia and London, J. B. Lippincott & Co. 1895. Pp. xvii+537.

The Structure and Development of Mosses and Ferns. DOUGLAS HOUGHTON CAMPBELL. London and New York, Macmillan & Co. 1895. Pp. viii+554. $4.50.

Laboratory Manual of Inorganic Preparations. By H. T. VULTÉ and GEO. M. S. NEUSTADT. New York, Geo. Gottsberger Peck. 1895. Pp. ii+180+iii. $2.

Indianische Sagen von der Nord-Pacifischen Küste Amerikas. FRANZ BOAS. Berlin, A. Asker & Co. 1895. Pp. vi+363.